MODEL

FLY BETTER WITH RUDDER

# AIRPLANE NEWS

THE WORLD'S PREMIER R/C MODELING MAGAZINE

48120

November 1995

## SOUND ADVICE! REDUCE ENGINE NOISE

—PAGE 44


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NOVEMBER 1995 VOLUME 123, NUMBER 11

# MODEL AIRPLANE NEWS

## FEATURES



**ON THE COVER:** at the 1995 Rally of Giants in Danville, VA, Ron Weiss's 1/3-scale Fleet Bipe takes to the air (photo by Walter Sidas). Inset: a high-altitude UAV produced by Scaled Composites carries the ultimate back-up system—a human pilot! (photo courtesy of Scaled Composites). Bottom: Rich Uravitch's OV-10 Bronco might be your best choice for a first twin (photo by Rich Uravitch).

**ABOVE:** a new design from Rich Uravitch—the OV-10 Bronco; see the full construction article on page 22.

## FEATURES



## CONSTRUCTION



## COLUMNS



## COLUMNS



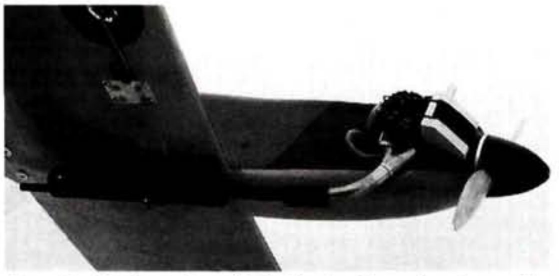
## DEPARTMENTS

# EDITORIAL

TOM ATWOOD

## SOUND QUESTIONS

To the modeler's ear, few things may sound as sweet as a properly adjusted model engine. The audible power surge of an engine just coming on the pipe, the throaty growl of a gas engine pulling a ¼-scale aircraft, the even cadence of a 4-stroke in a low-throttle flyby, the unmistakable resonance of a twin—these are, after all, typical sounds of modeling success. But for outsiders, they may be mere noises, and the louder among them may be reason to complain. The importance of minimizing engine noise at the flying field can be expected to grow, not diminish, as open land continues to be developed. Put another way, the better we control the noise of our models, the more flying fields we will be able to establish and maintain, and the larger our sport will become.



*Tore Paulsen's pattern "Spit Fire" with carburetor muffler and quieting tuned pipe. Tore flew the ship in two world championships.*

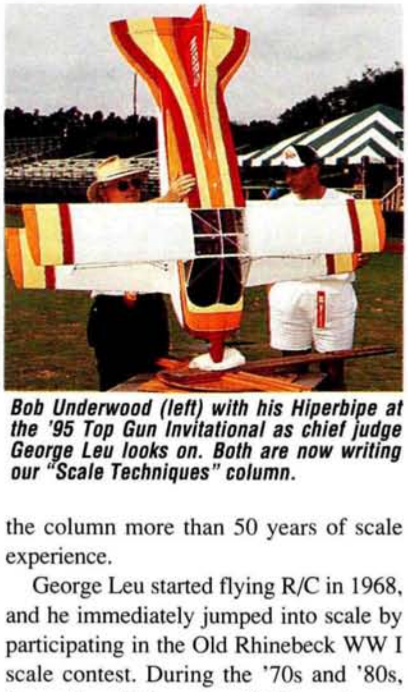
This issue includes the first article on sound control in a two-part series by respected Norwegian modeler, Tore Paulsen (see "Sound Advice from Europe"). Model-generated noise has been a critical issue in Europe for many years, and we felt that our readers could benefit from a look at a European approach.

In '71 and '72, Tore Paulsen was chairman of the FAI's CIAM (Committee for International Aeromodeling) noise subcommittee. The FAI is the global governing body for all sport aviation, both full-scale and aeromodeling. While chairing the noise subcommittee, Tore played a pivotal role in defining the causes and cures of excessive model noise for members of the FAI. He produced a technical paper that was warmly received by the delegates from the FAI's member states; much of this information is shared again in his series.

The first article reviews basics, including exhaust sound. In our December issue, Part 2 will show Tore's recommended muffler design and discuss basics of propeller and carburetor noise and airframe vibration. Also in that issue will be a ground-breaking performance comparison of leading quieting mufflers (including Tore's) by Dave Gierke. You won't want to miss these reports.

### NEW SCALE COLUMNISTS

Our scale column is now enjoying its third incarnation as "Scale Techniques," written by two well-respected scale personalities—1995 Top Gun chief flight and static judge George Leu and the AMA's own Bob Underwood. Together, they bring to the column more than 50 years of scale experience.



*Bob Underwood (left) with his Hiperbipe at the '95 Top Gun Invitational as chief judge George Leu looks on. Both are now writing our "Scale Techniques" column.*

George Leu started flying R/C in 1968, and he immediately jumped into scale by participating in the Old Rhinebeck WW I scale contest. During the '70s and '80s, he continued his scale activities and competed in pattern competition. George was the vice president of the National Society of R/C Aerobatics (NSRCA) and was involved in changing American pattern flying to FAI (turnaround) style. By 1984, he was involved in flying ducted fans; he wrote our "Jet Blast" column for four years and has been president of the Jet Pilot's Organization for the past two years. Today, George is heavily involved in scale at the national and masters levels, and he enjoys competing in local and regional contests. George is also writing for our upcoming special issue, *Radio Control Scale Models*.

Bob Underwood first flew R/C in 1967, became hooked on scale two years later and, by 1977, had pulled together people with a common interest in scale to form the National Association of Scale Aeromodelers (NASA—the scale special interest group for the AMA). Specializing in one-of-a-kind or otherwise seldom-built aircraft, Bob has been an FAI World Scale Team member four times. He took 2nd, 3rd and 5th in three of those meets. Bob has served as the technical director at the AMA for 10 years and is now the AMA's education director.

We thank Frank Tiano for doing a great job writing the "Sporty Scale" column for the past several years. Many of today's masters saw ink in his column for the first time. Frank is taking a sabbatical because of the competing demands of his deep involvement in the sport and the industry—witness the success of Top Gun. We look forward to his continued contributions as time permits.

### BUCKING BRONCO

Rich Uravitch's fantastic OV-10 Bronco construction article, the subject of much discussion around the workbench, is published in this issue. Rich says that it's his best yet! If you build one (it's going to be hard to resist), don't forget to send us a color print of the finished model for consideration in "Pilot Projects!" ■

MODEL AIRPLANE NEWS



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# AIRWAVES

**WRITE TO US!** We welcome your comments and suggestions. Letters should be addressed to "Airwaves," **Model Airplane News,** 251 Danbury Road, Wilton, CT 06897. Letters may be edited for clarity and brevity. We regret that, owing to the tremendous numbers of letters we receive, we cannot respond to every one.

## MORE FLYING TIPS

I really enjoyed Roger Post's article, "Avoid Crashes!" in the August '95 issue, but I'd like a few points clarified. In the "Stalling on climb-out" section, the author says, "To level the wings, add rudder in the direction of the high wingtip." Isn't this only true if the plane is heading away from you? If it is coming toward you, shouldn't you add rudder in the direction of the low wing?

In the "Landings" section, he says to "...pull back your throttle trim...." My throttle trim is adjusted so that the engine will idle when the throttle stick is fully back. If you adjust the throttle trim while landing the plane, won't you kill the engine and have a dead-stick landing on your hands?

Also in the "Landings" section, he says, "After touchdown, hold full up-elevator, and let the plane roll to a stop." It seems to me that you would hold full up-elevator on a tail-dragger airplane, but on a tricycle configuration, you would want to neutralize the elevator or give some down-elevator to keep the nose wheel on the ground and give it better tracking. I'd appreciate it if you'd help clear up these questions.

KEN SIEMERS
*Mountain View, CA*

*Ken, to answer your first question, have a flying buddy hold the plane (engine off) in front of you with its right wing down as if it were flying directly toward you. Move the rudder stick slowly back and forth to see the direction of the rudder movement in relation to the lowered wing. Moving the rudder stick to your right will give the plane a right-rudder input and lower the plane's right wing even farther. Moving the rudder stick to your left gives you a left-rudder input that will lower the higher left wing (which is on your right). Whenever the plane is flying right-side up and coming toward you, move the sticks in the direction of the lower wing panel. This gives an opposite control to the plane and levels the wing.*

*The answer to your second question is not to pull back the throttle trim all the way. I usually pull my throttle trim about halfway down, so that when I pull my throttle stick all the way, the engine will not quit. Again, check this on the ground and make sure that your engine will keep running with the throttle stick all the way down and the throttle trim part of the way down.*

*True, holding full up is appropriate for a tail-dragger, but I wouldn't add down-elevator to a tricycle-gear rollout, because if you were to touch down at a fast speed, you could raise the tail and flip the plane over. When I land full-size tricycle-gear aircraft, I hold in full up to relieve the pressure on the nose-wheel strut. A shimmy can develop when the plane is rolling out too quickly and the nose-gear strut has a lot of pressure on it.*

*Thanks for writing in.* RP

## SCRATCHING DESIGNS

I was pleased to discover the new scratch-building column. I have long wanted to take on a scratch project but, given the high quality of today's reasonably priced kits, I haven't been persuaded to take the plunge. *But* I've always wanted to create my own design from start to finish. I believe that many modelers would be interested in a reference book on model design written in layman's terms rather than the "Greek" that fills technical manuals. I'm looking for a resource that gives basic design parameters in the form of percentages and ratios that would allow me to plan my own original design with confidence that it will fly. I'm not particularly interested in strange and exotic designs—just some tried-and-true formulas that will enable me to realize my dream. Would you please consider addressing this concern?

ART GRIEPP
*Waxahachie, TX*

*Art, yes, the idea of publishing the basics of model design for the beginner*

*is a good one. We are considering some articles that would provide "recipes" for various types of planes, much along the lines that you are suggesting—stay tuned.*

*I spoke briefly to Jerry Nelson of Nelson Aircraft about this subject, and he gave us some off-the-cuff suggestions. Here are some ideas from his "Getting Started" article, which will appear in our upcoming special issue, "Radio Control Scale Models":*

*1. CG should be placed between 25 and 33 percent of the mean aerodynamic chord.*

*2. Horizontal stabilizer area should be at least 16 to 18 percent of the wing area.*

*3. The vertical fin/rudder area should be at least 40 percent of the horizontal stabilizer area.*

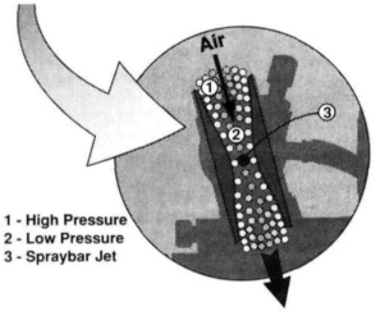
*4. Weight isn't too critical (within reason) if the plane has enough power and the runway is long enough to accommodate it.*

*5. And very important, the left side of the airplane should exactly mirror the right side. Accurate wing construction is also extremely important.*

*You can also move toward designing your own model by kit-bashing or melding features of various kits into a proven kit planform. Consider giving it a try!* GY

**ERRATA**

In David Gierke's "Setting the Idle" article in the September '95 issue, we inadvertently printed an incorrect illustration at the top of page 31. It should look like this:

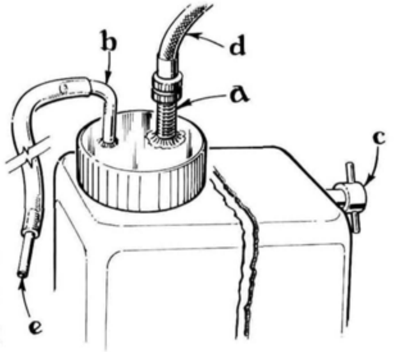


# HINTS & KINKS

JIM NEWMAN

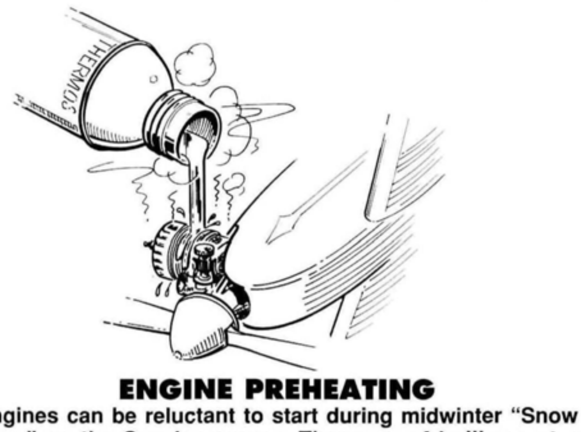
*Model Airplane News will give a free one-year subscription (or one-year renewal if you already subscribe) for each idea used in "Hints & Kinks." Send a rough sketch to Jim Newman c/o Model Airplane News, 251 Danbury Rd., Wilton, CT 06897. BE SURE YOUR NAME AND ADDRESS ARE CLEARLY PRINTED ON EACH SKETCH, PHOTO AND NOTE YOU SUBMIT. Because of the number of ideas we receive, we can't acknowledge each one, nor can we return unused material.*

## PRESSURE FUELING




No electricity needed! Solder a tire-valve stem (a) and a brass tube (b) into the cap of your fuel can and, if it doesn't have a sealable pressure vent (c), solder a second tube into the cap, which can be sealed off with a plug or a clamped fuel line. Connect your retract or tire pump (d) to the stem, then lightly pressurize until fuel flows. To stop fueling, open the pressure vent, or remove the plug as appropriate. The fuel-delivery hose (e) should be clipped up to keep it out of the dirt when not in use.

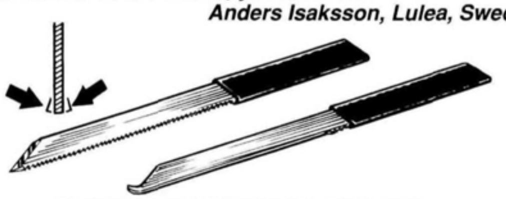
***Joe Letourneau, Brantford, Ontario, Canada***




## ENGINE PREHEATING

Engines can be reluctant to start during midwinter "Snow Flys," so the Swedes carry a Thermos® of boiling water that they pour gently over the upper fins and head after covering the carburetor intake. Anders says the engines then start "just like it was summer!" Preheating is commonly done on full-size aircraft with a hot air hose from an electric heater. How about it, you inventors?

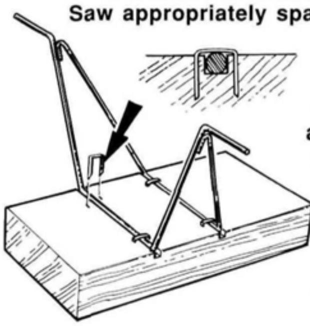
***Anders Isaksson, Lulea, Sweden***



## HINGE-SLOTTING TOOLS

Made of broken hacksaw blades (18 teeth per inch), these slotting tools cost only 5 minutes of your time on the grinding wheel. One tool pierces and cuts, while the hooked tool cleans out balsa splinters. Most effective if the "set" is ground off the teeth as arrowed. Heat-shrink tube makes a fine handle. ***Gene Chase, Oshkosh, WI***

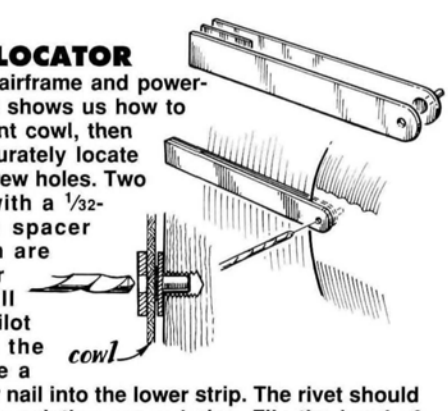
## VINTAGE LANDING-GEAR JIG



Saw appropriately spaced slots into a 2x4-inch (50x100mm) piece of wood. Staple the gear wires to the wood, then solder the wires together as shown. The secret is to allow the wires to protrude slightly above the surface of the block so that the staples will hold them firmly.

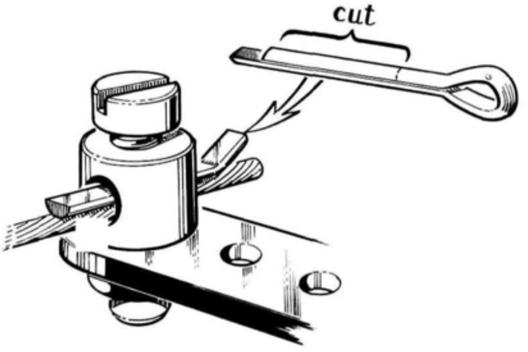
***Bill Braatz, Merrillville, IN***

## HOLE LOCATOR




This long-time airframe and powerplant mechanic shows us how to fit a replacement cowl, then easily and accurately locate the existing screw holes. Two metal strips with a 1/32-inch (0.8mm) spacer between them are glued together as shown. Drill only a small pilot hole through the pair, then glue a suitable rivet or nail into the lower strip. The rivet should fit snugly in the existing screw holes. File the head of the nail or rivet as thin as possible, then place it in the screw hole. Slip the cowl into place, and drill a pilot hole, which should be enlarged afterward to receive the cowl-attachment screw.

***Terry Brokaw, Three Rivers, MI***




## EFFECTIVE CABLE CLAMPING

If the setscrew doesn't reach the cable, cut one leg off a large cotter pin, insert it into the hole as shown, then torque down the screw. Use Loctite on the screw to prevent it from becoming loose.

***Keith Sparks, N. Richland Hills, TX***

HOW TO

# Use the Rudder

## *Effective left-hand control*

by ROGER POST

DID you start out on a 4-channel trainer and learn to fly with just your right thumb? Or did you learn on a 3-channel airplane (rudder included) only to upgrade to four channels and forget about the benefits of the rudder? Maybe you're an old single-stick flier who has finally purchased a two-stick transmitter. If you fit any of these descriptions, the following information will be beneficial to you.

### HOW THE RUDDER WORKS

The rudder controls the plane along its vertical axis. To visualize where the vertical axis is, just picture a horse on a carousel. Change the horse into a plane, and the pole runs vertically through its center of gravity (CG); see **Figure 1A**. The plane will pivot around this pole, which is the vertical axis. The movement around the vertical axis is known as yaw. When the rudder is moved to the right, the decreased camber on the left side of the vertical tail creates a lower pressure while the increased camber on the right side creates a higher pressure.

As a result of these opposing pressures, the tail swings to the left and the nose moves to the right. The opposite applies when the rudder is moved to the left. The rudder can also induce roll around the longitudinal axis; see **Figure 1B** (but more about that later). When you set up your plane's rudder deflection, make sure that you have a lot of throw and that it's equal in both directions. With the rudder, a little input can do a lot, and a lot of input—at the right moment—could save your plane.

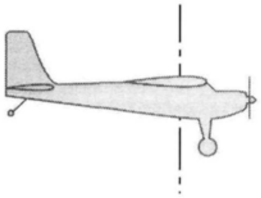


Figure 1A.
Vertical axis

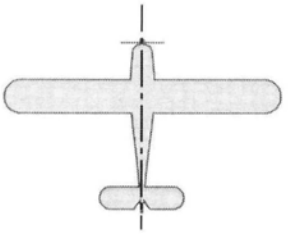


Figure 1B.
Longitudinal axis

***Figure 1A. Location of the vertical axis. The plane pivots around this axis, and that's known as "yaw." Figure 1B. The longitudinal axis extends from the nose to the tail.***

• **Rudder use on the ground.** Do you have problems taxiing into the takeoff position? If you do, it helps to do some taxi practicing with a throttle setting just above idle. The throttle will control your forward speed, so use it sparingly. If your plane happens to get stuck while taxiing, wiggle the rudder stick back and forth while you give some bursts of throttle. This will usually get the model to advance. A little up-elevator on nose-gear airplanes helps, too.

• **Rudder use on takeoff.** Do you get frustrated with the aircraft straying left on the takeoff run? The following information tells you why this happens and how to correct it. Three things will cause an airplane to veer to the left during the takeoff run:
• engine torque;
• spiraling slipstream;
• gyroscopic precession.
Four things will cause it to veer to the left during climb-out:
• the aforementioned factors;
• asymmetrical thrust.
In the following, numbers 2, 3 and 4 are quotes from "Sanderson's Private Pilot Manual," by Sanderson (published by Jeppensen & Co., 1972).

**1. Engine torque.** Just imagine a vertical torque roll—prop spins right, plane rolls left.

**2. Spiraling slipstream.** "The propeller also induces a slipstream rotation which causes a change in flow direction across the vertical stabilizer. Due to the direction of propeller rotation, the slipstream strikes the left surface of the vertical fin causing the airplane to yaw left."

**3. Gyroscopic precession.** "Can be explained as the resultant action or deflection of the spinning object when a force is applied to this object. The reaction to a force applied to a gyro acts approximately 90 degrees in the direction of rotation from the point where the force is applied. Therefore, if an airplane is rapidly moved from a nose-high pitch attitude to a nose-low pitch attitude, gyroscopic precession will create a tendency for the nose to yaw to the left. The left-turning force is quite apparent in tail-wheel type airplanes as the tail is raised on the takeoff roll."

**4. Asymmetrical thrust.** "In a propeller driven airplane at a high angle of attack asymmetrical thrust is created because the descending propeller blade on the right side of the engine has a greater angle of attack than the ascending blade on the left. This produces greater thrust from the right side of the propeller resulting in a left yaw known as "P-factor" (propeller factor). It should be remembered that P-factor creates a left-turning tendency only when the airplane is flying with a positive angle of attack. P-factor is not prevalent in level cruise flight since both propeller blades are at the same angle of attack, producing equal thrust."

As you can see, all these factors lead to a left-turning tendency that can be corrected only by using right rudder to keep the plane straight on takeoffs and climb-outs. If you have built a scale model of a plane that uses a counterclockwise prop rotation (as viewed from the cockpit), all the above principles would be reversed, and you would use left rudder to correct the right-hand yawing tendencies.

Many articles have been written on the subject of sub-fins and sub-rudders and how they help to counteract the one-sided effects of spiraling slipstream. One that comes to mind is Carl Risteen's article about flight performance in the August 1995 issue of *Model Airplane News*. A section of the article—on sub-fins and sub-rudders—helps to explain the benefits of having equal vertical areas above and below the thrust line.

• **Rudder use in the air (coordinated turns).** Did you ever notice your plane's tail slip in the direction of the turn while its nose swings in the opposite direction? This is adverse yaw at work. Rudder input that

precedes aileron input will correct this and give you a smooth, coordinated turn. If you find it too difficult to move the left stick before the right stick, you can move both sticks at the same time to achieve the desired effect; see **Figure 2.**

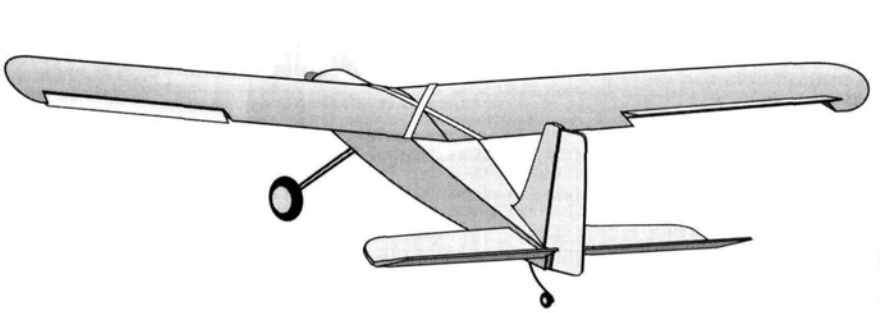
At first, you might input too much rudder while you try to coordinate your turns. You'll recognize this when you see the tail of your plane go to the outside of the turn and not track neatly behind the nose. This is called "skidding." Coordinated turns can really make your flying look smooth and precise, but they do take practice.

• **Coupling.** Some fliers like to couple their rudder to their aileron stick and use only one thumb. In my opinion, this does not help you to develop any left-thumb agility, and it can fail you at the most inopportune time. For example: most coupled rudder inputs do not have adequate deflection; to correct an unusual attitude at a slow air speed during landing, the plane may need more rudder input than is available through coupling. The pilot uses the aileron stick to correct the attitude, but the drag of the down aileron creates some adverse yaw and stalls the wing at the slow air speed, and the plane crashes. Ailerons will only correct a yaw misalignment when the plane has adequate air speed, but it takes some time to react; the correction looks awkward, and if you were in a full-size plane, it would feel awkward. Precise, smooth, coordinated turns require both thumbs.

## 3-CHANNEL FLIGHT

If you start with a 3-channel airplane, it will probably have some dihedral for lateral control stability. The more dihedral the plane has, the more it will try to right itself when placed in a banked attitude. This dihedral creates some interesting control responses when you fly inverted.

Now, before I cover inverted, rudder-only flight, let's talk about how the rudder makes the wing react. When you give a rudder command, the wing half that's on the outside of the turn generates more lift because of its new angle of attack in relation to the relative wind. The best way to visualize this is to have a friend hold a dihedralled wing in front of you (leading edge faces you); see **Figure 3.** Imagine that your line of vision is the relative wind. Now have your friend rotate the wing slightly on its vertical axis. You will start to see more of the bottom of the wing panel that's on the outside of the turn and more of the top that's on the inside. The relative wind is now blowing diagonally



4-channel coordinated right turn

***Figure 2. These are the control inputs for a right-hand coordinated turn. Rudder and aileron are the first inputs. Once the plane banks, add in up elevator to hold altitude and neutralize the bank input. (Note that the control-surface deflections have been exaggerated for clarity.)***

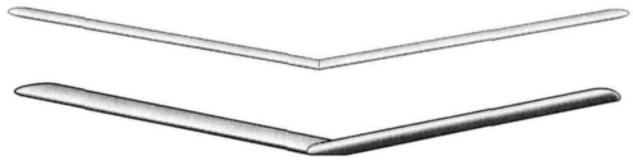


***Figure 3. The top drawing is a front view of a dihedralled wing. The bottom drawing shows the wing turning right on the vertical axis. You can see the bottom of the left panel and the top of the right.***

3-channel inverted left turn

***Figure 4. When you fly a 3-channel plane inverted, right rudder input makes the plane go to the right, and left rudder makes it go to the left. Here we see an inverted plane with left-turn control inputs. The arrow on the left indicates that the wing will drop and allow the plane to turn in that direction.***

4-channel inverted coordinated right turn

***Figure 5. The rudder input yaws the nose in the direction of the turn. The aileron input will bank the wing, and the down-elevator input will maintain altitude and help tighten up the turn. (Again, the bank controls are used first and then the added elevator holds the altitude. Control inputs are exaggerated for clarity.)***

ILLUSTRATIONS BY JONATHAN KLEIN

across the wing and pushing up on the bottom of the leading edge of the outside panel and pushing down on the top of the trailing edge of the inside panel. So the wing panels act as a large set of ailerons. If you give a significant amount of rudder input, the outside wing will eventually rise and go over the top of the fuselage and create a roll on the longitudinal axis. It won't be an axial roll by any means, but it will be a smooth, slow roll with some added down-elevator in the appropriate spot; and you can do barrel rolls of various roll rates and sizes. I have rolled many Florio Flyer* Nifty 50s with great results. I've even rolled rudder-only, polyhedral gliders and trainers (with some funny-looking results).

It seems that the shape of the wingtip

also helps a plane's rolling ability. With the flat-bottom wing, a tip that slants upward from the bottom to the top will help the plane to roll.

• **Inverted.** Frustrated with 3-channel, dihedral-wing aircraft in inverted flight? Maybe these tips will help you.

First, enter inverted flight by doing a half loop or half roll. Once you are inverted, to maintain altitude, you must maintain an adequate power input. Also, to achieve a slight, positive angle of attack, add some down-elevator; but don't add so much that you stall the wing.

Now the fun begins! Believe it or not, if you move the rudder stick to the left, the plane will actually turn left (this left-hand turn is relative to how you see the plane from the ground while it's *flying away* from you); **Figure 4.** From the plane's perspective, the nose initially swings to the *plane's* left (your right), and then the right wing (on your left side) drops, and the plane turns to its right (your left). You may find that, to get the plane to bank in the desired direction, the rudder input has to be increased. Once the plane has started to bank, add enough down-elevator to maintain altitude and turn the plane. The amount of elevator input determines the tightness of the turn. To prevent the plane from rolling right-side up, you'll probably have to add some opposite rudder. This combination is a bit tricky to master at first because you'll input more control than is necessary. But once you've learned how not to over-control, you'll achieve a smooth, inverted turn.

From here, the best thing to do is to practice horizontal figure-8s. This exercise will help you to balance your right- and left-hand inverted turning abilities. Any confusion about right or left (whether the plane is coming toward you or flying away from you) can be alleviated by always thinking that you're flying right-side up. If the plane is coming toward you (inverted), the rule still applies: *move the stick toward the low wing*. Of course, the elevator is opposite.

## 4-CHANNEL FLIGHT

When you fly a 4-channel aircraft, inverted coordinated flight will require input from both thumbs. An airplane with no dihedral and a symmetrical airfoil uses opposite thumb inputs to coordinate its inverted turns. This is because the rudder reacts as you would expect it to: left rudder makes the plane go right and right rudder makes the plane go left (viewed from the ground with the plane moving away from you). So when you initiate an inverted turn, right rudder will make the plane's nose turn left. Add left aileron (ailerons are the same right-side up or inverted) and some down-elevator, and you have an inverted coordinated turn. Of course, the reverse rudder and aileron inputs are used for a right-hand turn. If the plane is flying toward you, to level it, move the aileron stick toward the low wing. Because the leveling should be a coordinated input, the rudder stick will move in the opposite direction to the aileron stick.

If your 4-channel plane has dihedral and a flat-bottom wing, you'll need more of an angle of attack to maintain level inverted flight. This is where achieving smooth, coordinated turns becomes tricky. Once you're inverted, to eliminate the need for a lot of down-elevator, it helps to add some down-trim. For a left turn, push the sticks toward each other; for a right turn, pull them apart. **Figure 5.** To tighten up the turn, add more down-elevator. If the wing starts to drop too much, add the opposite turn control to prevent the plane from rolling right-side up. I've found that only very small inputs on the sticks are needed to achieve a smooth, coordinated turn.

If you're flying in windy conditions, your thumbs will constantly be making minute lateral movements. Some extra down-elevator and added power inputs might be needed while turning. This gives you a busy set of thumbs. All the motion, however, is very close to the center of the neutral stick position. Practice this one with enough recovery altitude to allow you to *roll* out if you get into trouble. All you have to do is move both sticks in the same direction, and the plane will roll right-side up.

• **Left-hand practice.** When you fly, is your left hand off the rudder (throttle) stick? Does your plane go in because your left thumb reacts too slowly? This exercise will wake up that sleeping left thumb and help to bring that plane home in one piece.

Once your plane has reached a safe altitude, you can try to fly it with just your left hand. Yes, it's true; an airplane will fly with just left-hand inputs. You need to reduce your throttle and to input some up-elevator trim so that the model will maintain altitude hands-off. Also, trim it so that it's laterally stable (aileron and rudder trim). Now all you need to do is turn the plane with the rudder and add some power if you start to lose altitude (power is altitude). If your right bank becomes too steep, input some opposite rudder. To prevent the plane from overbanking, you may find that you have to hold some left rudder and added power. This will give you a nice, smooth turn. When you've finished the turn, level the wings with a little more left rudder, reduce the power setting to where it was for level flight, and neutralize the rudder stick. The opposite applies if you turn to the left.

Some things to keep in mind when you use just your left hand are:

• Put your right hand in your pocket or behind your back, and use it only if it's absolutely necessary.

• Smooth, minute control inputs are necessary (over-controlling will make the plane go all over the sky and cause frustration).

• If you lose altitude, add power.

• Always practice with recovery altitude.

## OTHER APPLICATIONS

**I covered how to use the rudder during crosswind landings and slips in my two previous *Model Airplane News* articles: August 1995, "How to Avoid Crashes" and September 1995, "How to Slip an Airplane." If you have questions on rudder use concerning these two subjects, please refer to the articles. How to use the rudder for knife-edge flight and aerobatics is covered in Dave Patrick's book, "Radio Control Aerobatics For Everyone." I recommend this book to anyone who wants a good introduction to aerobatics; this introduction is thorough and easy to understand and is available through Air Age Publishing.**

## CONCLUSION

I hope this answers some of your questions about the rudder and why you need to use it. Waking up your left-hand inputs (in the Mode II transmitter configuration) will save your model and allow you to spend more time flying and less time rebuilding. Try to set up your 3-channel plane with rudder and power on the left stick and elevator on the right. If you have a computer radio, you can "slave" the aileron stick to the rudder channel; that way, if you forget to use your left stick in time, you can save your plane instinctively with the right hand.

As always, I welcome your comments and suggestions concerning safety and proficiency. Good luck, and keep those planes in one piece. ■

**Addresses are listed alphabetically in the Index of Manufacturers on page 134.*

# AIR SCOOP

CHRIS CHIANELLI

*New products or people behind the scenes; my sources have been put on alert to get the scoop! In this column, you'll find new things that will, at times, cause consternation, and telepathic insults will probably be launched in my general direction! But who cares? It's you, the reader, who matters most! I spy for those who fly!*

## Push the Limit

In an effort to produce an all-out machine, Robbe has pulled out all the stops designing the Limit. In all of 1994's major international F5B competitions, European contender Urs Leodolter had an impressive series of wins with this model. The computer-calculated fluid profile of the Limit is constructed of a Kevlar-reinforced fuselage and a one-piece wing and stab—both with carbon-fiber spars to withstand a high-G loading. The large radio compartment below the wing offers easy access to the electric power system with room for 27 cells. For more information, contact Pica/Robbe Inc., 2655 N.E. 188th St., Miami, FL 33180; (305) 932-1575; fax (305) 937-2322.


**Sometime during the '70s, in the R/C community, the word "Stick" became synonymous with the term "intermediate trainer." Big Stick, Little Stick, Quick Stick; the variations seemed endless. Now Thunder Tiger has introduced a version that will get you into the air fast—the Tiger Stick 40S ARF. Built and covered by skilled craftsmen, the all-wood Tiger Stick features a computer-designed airfoil that combines stability with outstanding aerobatic performance. Spinner, wheels, tank, engine mount and hardware are all part of this complete package. Specifications: wingspan—58.5 inches; area—714 square inches; weight—5.1 pounds; power required—.40 to .46 2-stroke; channels required—4. Contact Thunder Tiger USA, 2430 Lacy Lane #120, Carrollton, TX 75006; (214) 243-8238; fax (214) 243-8255.**

## Ristickulously Quick

Henry Haffke's Gentle Gee Bee (our December '94 construction feature) has turned out to be such a success story that this new Y-model has come into being. Popular because of its pretty, scale-like appearance and super-gentle flight characteristics, the 58-inch-wingspan Gentle Gee Bee's basic moments have been incorporated into this latest creation. Henry simply replaced the "scale-like" appearance with the more authentic scale appearance of the Y-model. Many feel the Y-model's flowing lines make it the most beautiful Gee Bee of all. Drop me a line and let me know what you think.


## *Gee Bee Genesis*

## R/C Business

Great Planes introduces the eight-passenger business jet Learjet 35A in .40-size and balsa-kit form. The surprisingly low-part-count design features a fully sheeted fuselage and ridged D-tube construction, and a partially sheeted wing with built-in tip washout. Die-cut pushrod passages and angled servo mounting in the aft radio compartment make it easy to guide the internally concealed pushrod to the scale T-tail. Scale appearance is achieved with ABS vacuum-formed tip tanks, engine nacelles, a canopy and window decals. According to its manufacturer, the Lear is fast, yet it handles much like the forgiving Great Planes Ultra Sport. Specifications: wingspan—55.5 inches; weight—6.5 to 7.5 pounds; wing area—554 square inches; engine requirements—.40 to .50 2-stroke.

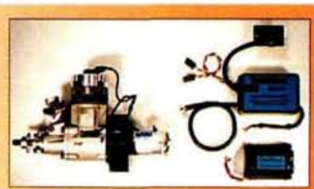
## Ohio in Baltimore

**This past June, at the MARKS show in Baltimore, MD, I caught up with Mike Ankney of Ohio R/C, and he showed me their latest—this 70-inch-wingspan Extra 300S. If you've been looking for a home for that .90 to 1.08 2-stroke or 1.20 to 1.50 4-stroke, this is the perfect project. It features the high-quality, precision machine-cut balsa construction Ohio has become famous for. Mike tells me Ohio will be having more releases for those homeless 1.08/1.20 engines many of us have around the shop. In the meantime, the new 300S should be available by the time you read this. My O.S. 1.60 twin will now have a place to sleep. For more information, contact Ohio R/C, 4251 Lutheran Church Rd., Germantown, OH 45327; (513) 859-1660; fax (513) 859-7202.**

## *On The Horizon*

Two new items from Horizon Hobby Distributors! First, the inexpensive, 2-channel, 2-stick, AM Beat Gear radio. Perfect for sailplanes, slope soarers and ½A projects, the Beat Gear features: two 510 servos; receiver; switch harness; battery box; servo-reversing; and JR's famous comfortable "Biocurve" transmitter design. Second—for those who like "pretty" power—the Saito .91 has been newly knighted and joins the ranks of the FA-120SGK and FA-150GK—available suited in gold and black armor with the title of "FA-91GK." Arise Sir Saito! Stand and be recognized, and be thee blessed with a life runneth rich!

## ASP AutoStart



TouchStart introduces a breakthrough in engine-starting technology for R/C fun and realism. The patented AutoStart system allows the engine to be started from your transmitter, yet it adds only 14 ounces to the flying weight. Think of it: no running out on the field like a fool when your engine quits after a long taxi out to the end of the runway. One simple command from the transmitter and the engine comes back to life—very cool. The system features a solid-state controller/power supply and a starter mechanism that's mounted on the engine. Systems are packaged with an ASP .61 R/C engine and come with a specially designed 12V Ni-Cd battery. Safety is enhanced by virtue of its hands-free operation; unit reliability is backed by a 90-day manufacturer's limited warranty. AutoStart for other engines to follow. List price—$599.84 (with ASP .61 R/C). For more information, write TouchStart Inc., P.O. Box 13985, Tallahassee, FL 32317-3985. Dealers only, call (904) 893-5339.

# PILOT PROJECTS

## A LOOK AT WHAT OUR READERS ARE DOING

### SEND IN YOUR SNAPSHOTS

*Model Airplane News is your magazine and, as always, we encourage reader participation. In "Pilot Projects," we feature pictures from you—our readers. Both color slides and color prints are acceptable.*

*All photos used in this section will be eligible for a grand prize of $500, to be awarded at the end of 1995. The winner will be chosen from all entries published, so get a photo or two, plus a brief description, and send them in!*

*Send those pictures to: Pilot Projects, Model Airplane News, 251 Danbury Rd., Wilton, CT 06897.*

### LOOK OUT BELOW!

Gerard Ford of Hawthorne, CA, has added new meaning to the classification, "sport utility plane." A BTA autopilot keeps his modified Senior Telemaster steady in the air while it releases gliders and parachutes and drops water-balloon bombs. Powered by a Davis Diesel-converted O.S. 61SF, the plane has piggybacked 10-foot-span gliders into the sky, and it can also take in-flight photos. Gerard admits that he still needs to practice his aim a little; until he does, we hope the R/C fliers at the Apollo II flying field in Hawthorne (see inset photo) watch out!


### BOEING BIPE

Retired LTC Gerald Blumenthal of Southfield, MI, sent this photo of his friend's "superior Boeing F4B4 from scratch." Frank Rogers deserves the credit for building this plane, which is powered by a radial Saito 70 4-stroke. It sure is a beauty, Frank!


### TANDEM TRAINER

This AT-6 Texan was built from an Aeroplane Works kit by Raymond Dupuis of St. Armand, Quebec, Canada. It has a G-62 powerplant and Robart retracts, and the paint scheme is patterned after that of a plane at the All Weather Flying Center at the Clinton County Air Force base. Raymond explains that the exhaust is on the wrong side of the plane because the engine is inverted.

### FROZEN FLIER

P. Wahlsten of Vasterhaninge, Sweden, scratch-built this seaplane, "Sneader 60," from his own plans. The 60-inch-span model is powered by an O.S. 61 marine engine and is extremely fast and maneuverable. The fliers in Sweden always wait eagerly for summer, but "Till then, we fly on snow on a lake south of Stockholm."

### ALLIED DOGFIGHTER

Lauri Nurminen of Helsinki, Finland, built this ⅙-scale Sopwith Camel from a VK Models kit. It uses a Saito 80 4-stroke for power and has a Prop Master 12x6 prop. The plane hasn't been flown yet, because Lauri's brother is using the model in a photo session as part of his education program in photography. Both Nurminen brothers are active R/C fliers.

CONSTRUCTION



# North American Rockwell OV-10 BRONCO

by RICH URAVITCH

*Try your hand at a small displacement, simple scale twin*


IN R/C MODELING, nothing can match the unmistakable song of two (or more) engines operating in synch, occasionally "beating" against each other's frequency as their rpm vary slightly. The distinctive sound of twin engines stands out even more in models than in full-scale airplanes. It's modeling magic, so let's try some wizardry!

In the size presented here, the Bronco gives you an opportunity to try your first twin. It's both easy and inexpensive to build, and it's a lot of fun to fly.

Building consists of creating three basic "box" structures for the fuselage and twin nacelle/booms and a constant-chord, no-dihedral wing constructed right on the building board. It doesn't come much easier than this! A quick look at the numbers (weight/wing area) will show you that the wing loading falls right into the moderate "sport" category—definitely out of the glider/trainer population, but easily managed by any modeler who's comfortable with a sport/pattern model.

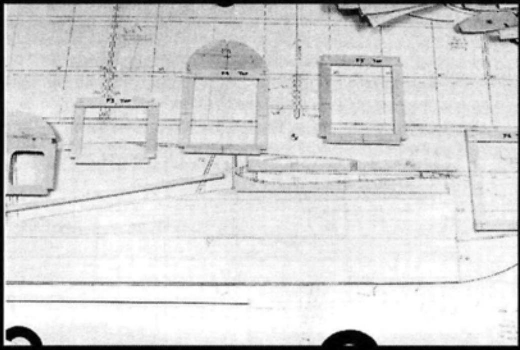
## MULTI MYTHS

It seems that the major reason we don't see more twins out there is the fear of the dreaded "engine out" syndrome. You'll probably be told that *all* twins crash when you lose an engine. The guy giving the advice probably offered it while he was flying his three-year-old trainer (which he has yet to land successfully at the chosen spot!).

Fact is, when one engine heads south, twins are quite manageable, as long as you recognize what's going on. Lose an engine? Don't panic; chop the power on the good one, re-trim to minimize the yaw and head back to the runway. Even if the remaining engine quits, at worst, you have a glider that you can dead-stick (something you've probably done with single-engine models many times before!). In the case of the Bronco, the rudders are sized to provide enough authority to compensate for yaw created by an engine-out.

In addition, the right engine should have 3 degrees of right thrust incorporated when you mount it. Thrust is *not* built in, so be sure to add washers as necessary between the engine mount and firewall to achieve the desired thrust setting. The left engine should *not* have right thrust. There; that should reduce the risk you think might be involved with your first twin. Want more insurance? Power your Bronco with a couple of geared 05 or direct-drive 15 electrics. The probability of one quitting is pretty remote!

If you started building right away instead of reading up to this point, you've probably got the wing half framed up! Let's continue....



*1 Cut out the fuselage sides, add the wing-saddle parts and the 1/4x1/4-inch balsa longerons, then assemble bulkheads F-1 through F-6 as indicated on the plan. Remember to make left and right fuselage sides!*

## PRESENTATION

To make building your OV-10 as easy as possible, the construction is presented as a series of captioned photographs which, when used with the notes and details on the plan, should answer all your questions. Ten preliminary sets of the plan were sent to modelers who had expressed an interest in building the Bronco. As I write this, seven models have been completed, and the recommendations of their builders have been incorporated on the final plan.

The first model completed is the camouflaged beauty. It isn't mine! It's owned by fellow Suffolk Wings member Rolf Kluge, was built by Eddie Hirschfeld, painted by Mike Jacobs and test-flown by Mike Gross! This group of my R/C buddies was so enthusiastic about the Bronco that the airplane was finished and ready to fly before my prototype was! Kind of made it nice, since all I had to do on test-hop day was provide moral support and take a few pictures! Truly a team effort!

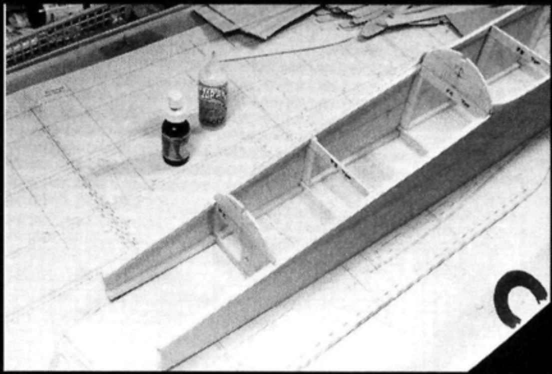
To make completing your Bronco a little quicker and a lot easier, I offer a set of vacuum-formed plastic parts: a large, transparent canopy, a pair of engine cowls, a nose cap and a rear fuselage fairing. Including shipping, the package costs $27.95 in the U.S. Contact me for overseas and Canadian prices. This package is available *only* through me; please do not try to order it from *Model Airplane News* when you order the plans; *they do not stock the parts package!* Order from me: Rich Uravitch, 1094 Glendale Ave. NW, Palm Bay, FL 32907; phone/fax (407) 728-0486.

## BUILD A BRONCO!

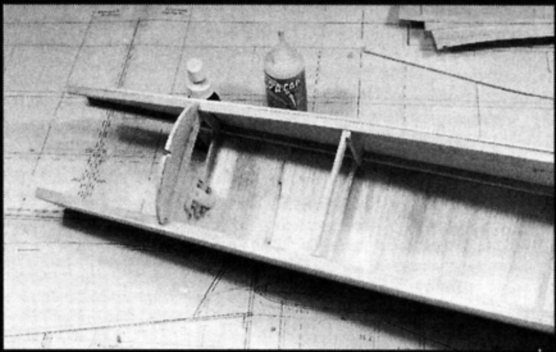
• Tail group. Both vertical fins and the horizontal stabilizer are built up in a similar way. The basic framework is made of 1/8x1/2-inch lite-ply strips with balsa diagonals. The frame is covered with 1/16 sheet balsa. To allow you to install the required hinges more easily, the lite-ply strip that forms each component's trailing edge is replaced with medium balsa. Note that *only one* of the vertical fins requires that a cable/conduit assembly be built in during construction; this is for elevator actuation.

### SPECIFICATIONS

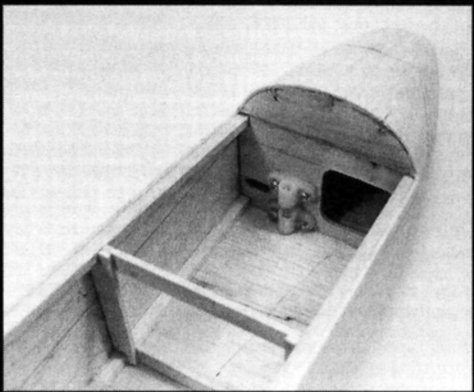
**Model name:** OV-10 Bronco
**Designer:** Rich Uravitch
**Wingspan:** 52 in.
**Length:** 52 in.
**Wing area:** 533 sq. in.
**Weight:** 5 to 6.5 lb.
**Power req'd:** two .20 to .25 glow engines
**Wing loading:** 21.5 oz./sq. ft.
**No. of channels req'd:** 4
(aileron, elevator, throttle, rudder)



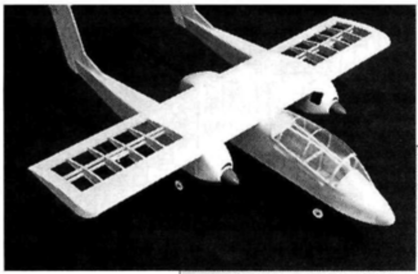
*2 Install bulkheads F-2 through F-6, making sure that everything is square to the building surface. That all the bulkheads are the same width makes this a little easier.*

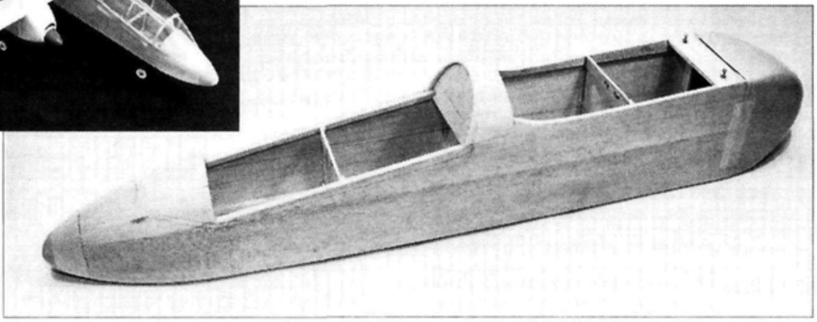


*3 To make installation of bulkhead F-1 a lot easier, use a razor saw to make a series of vertical "kerf" cuts in the balsa longerons between F-1 and F-2.*

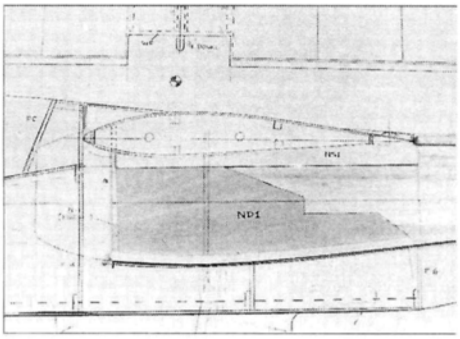


*4 The birch ply F-2 bulkhead installation; the triangular stock has not yet been added. Note that the nylon nose-gear steering block is offset to the left side to compensate for the coil bend in the wire strut.*

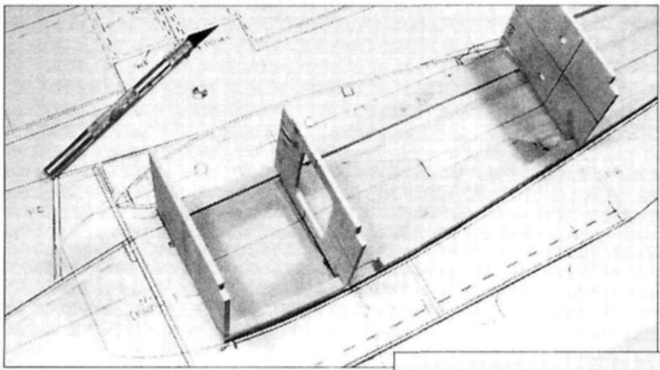




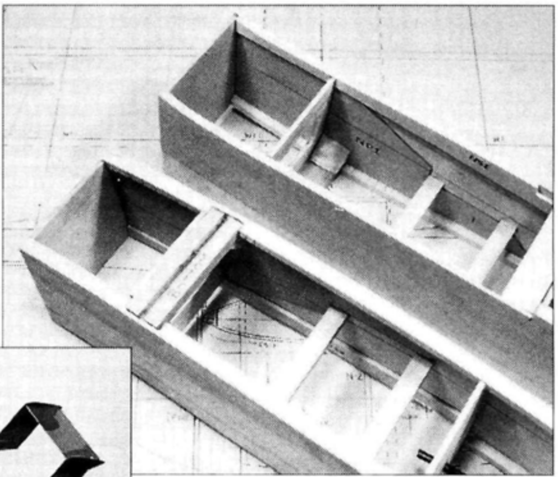
**5** *The completed fuselage with the plastic nose and tail caps in place—basically a box! Install the cockpit floor after completing the nose-gear steering linkage and battery installations.*



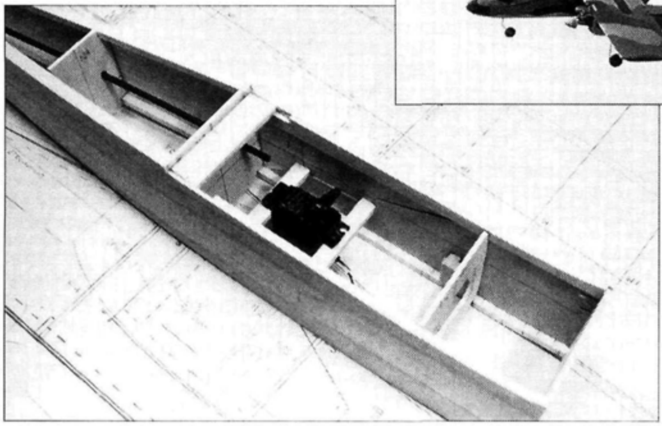
**6** *Another box! Nacelles are built up in much the same way as the fuselage. Here, the wing saddle, ply doublers and longerons have been added to one side.*



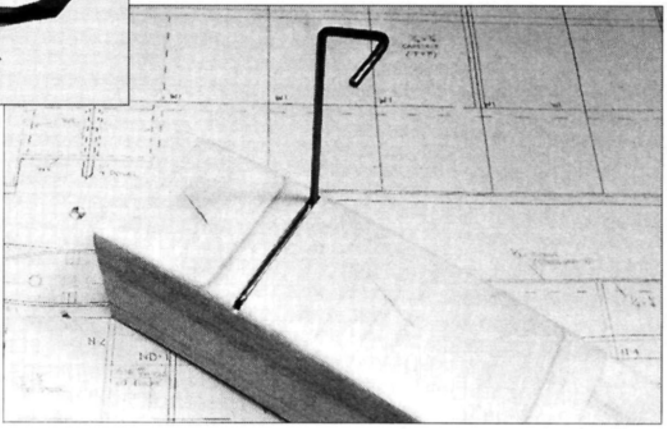
**7** *Add bulkheads N-1 through N-3. Again, squareness is important to ensure true flying qualities.*



**8** *Both nacelles before the balsa sheeting had been added. In this picture, the lower assembly is inverted to show the landing-gear block installation.*



**9** *The rudder (or elevator) servo has been installed in the nacelle/boom. The throttle servo will be next to, or forward of, this servo—plenty of room for the fuel tank!*



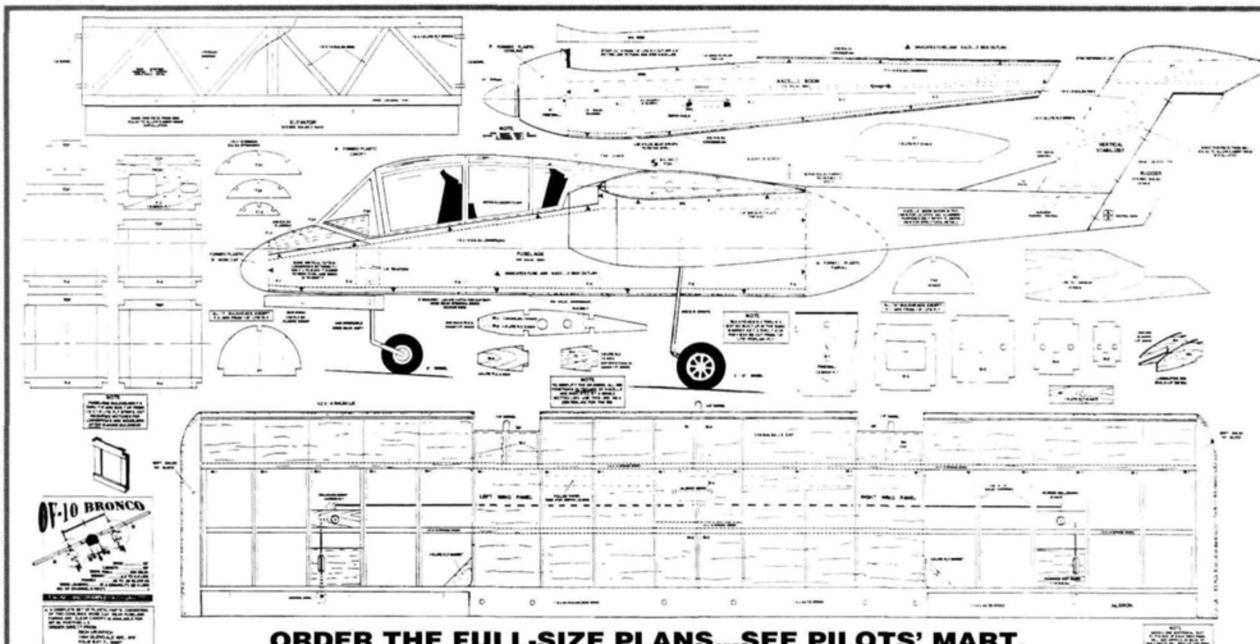
**10** *The lower surface of the nacelle after the balsa sheeting (cross-grain) and 5/32 music-wire gear strut had been installed. Retainer straps haven't been installed yet.*

• **Engine installation**. The OV-10 will accommodate any engines in the .20 to .28 range. I'm reasonably confident that, built light enough and covered with film, the Bronco would fly well on a pair of healthy .15s! My original has a pair of HP* Gold Cup .20s that are really smooth, reliable and quiet. Rolf's uses twin O.S.* .25FP's, and buddy Tim Farrell's gets its motivation from a couple of O.S. .26 Surpass 4-strokes.

Regardless of the engines you select, the more reliable, the better. Most important, when doing the installation, don't forget the right thrust settings for the right engine! Also, if, when flying your Bronco, you find it's power-trim sensitive (i.e., adding power produces a climb without elevator input, and reducing the power makes the nose come back down), you might need to add a little downthrust. Once again, as you did when you added the right thrust, place two or three washers between the firewall and engine mount at each of the two upper mounting bolts. This will tilt the engine downward and neutralize thrust-induced climbing tendencies.

• **Control system.** Because of its twin-engine, twin-boom configuration, the Bronco requires more servos than you'd expect. Although it only has the basic four controls (aileron, elevator, throttle and rudder), moving the rudders and actuating the nose-wheel steering and the throttles requires either additional servos or wire linkage. For simplicity, I chose servos and Y-harnesses.

If you like, you can trade a few bucks and some weight savings for additional complication and reduced reliability by mechani-




**ORDER THE FULL-SIZE PLANS...SEE PILOTS' MART.**

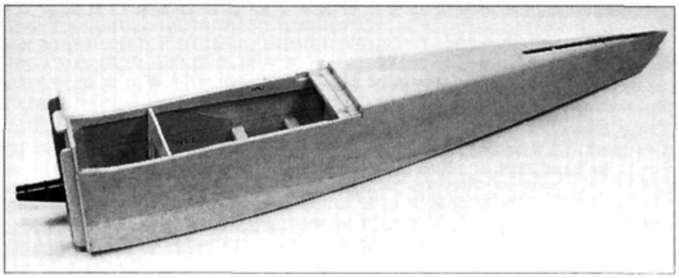
cally interconnecting the rudders with a wire cross-linkage running under the horizontal stabilizer. Likewise, the throttles can be actuated by a single servo that's mounted in the wing center section and drives music-wire pushrods to bellcranks in the nacelles. Remember, however, that if you plan to take your Bronco apart to transport it, this mechanical linkage will have to be disconnected every time you assemble/disassemble the model.

In all instances, the nose-wheel steering will require an additional servo in the fuselage right behind the steering arm. Servo Y-harnesses and extensions may be made or bought, depending on your specific installation requirements.

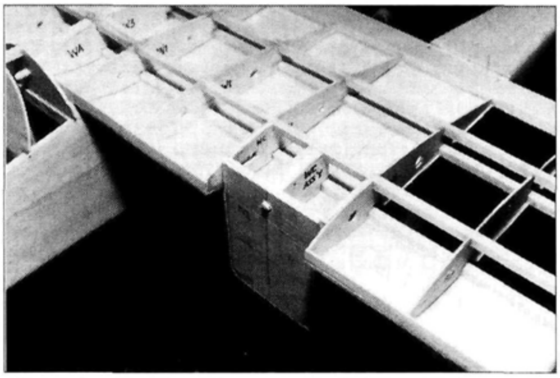
• **Horizontal stab.** Getting the little Bronco to the field, or even putting it into a box to ship to fun-flys and contests, is a piece of cake, especially if you make the horizontal stab removable. Instead of *gluing* the stab permanently into place between the two vertical fins, temporarily position the stab, and glue a piece of *hardwood* triangle stock to the *inside* face of each vertical fin, butted against the lower surface of the horizontal stab. The triangle stock forms a "platform" for the stab. After bolting the nacelles and fuselage to the wing and making sure that everything is properly aligned, drill through the stabilizer and the triangle stock and install a sheet-metal screw of the appropriate size. Remove the screw, harden the area around the hole with some thin Zap*, and you've finished.

You'll now be able to "shrink" your Bronco into a very small package; you'll be able to take *two* of them to the next Small Steps Fly-In! Whether you choose to make the stabilizer permanent or detachable, you should still use the dowels shown on the plans to ensure you have the proper stabilizer incidence.

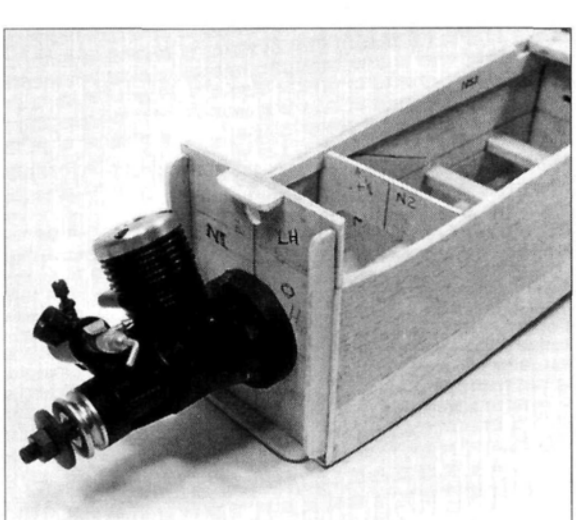
• **Preparation and covering**. After completing all the basic building, installing the control system and fitting any additions you choose (including the plastic parts), final-sand the airframe components.



**11** ***The completed nacelle/boom; Hayes* engine mount used.***



**13** ***A dowel captured by assembly "WC" and held by nylon bolts that go through the trailing edge aligns the nacelle/boom with the wing.***



**12** ***The engine installation. Rotate the mount until the muffler exits the cowl at the best location (see thrust-setting notes on plan). Note the strips of plywood for the cowl-retention screws.***

Use scrap balsa to form small ledges onto which you'll glue the plastic nose and tail caps. Fair the balsa into the plastic with your favorite lightweight filler.

Reassemble the entire airframe to make certain that everything fits properly and that there aren't any gaps or other imperfections that your modeling buddies will be sure to bring to your attention. After wiping down all the parts with a tack cloth to remove all the sanding dust from the wood grain, finish your Bronco with your favorite material or technique.

I covered my OV-10 with a combination of MonoKote* and Ultracote* film. After applying a coat of Balsarite* Film Formula and aerating the surface with the Woodpecker*, I applied the covering to approximate an OV-10 based at the Naval Air Test Center at Pax River, MD. The scheme is bright, highly visible and unique; the films, though not perfectly "color accurate," are excellent, quick-to-apply approximations. I should mention that I've never been particularly fond of—or good at—film finishes, but using these covering aids has improved the look of my film-covered projects to an almost acceptable level! Rolf's model is covered with Solartex* and painted with Cheveron* Perfect Camouflage Flats; all the vinyl lettering on my model was provided by AMP Graphics*. If you'd like to duplicate my scheme, I have additional sets available. The sets include all the lettering but *not* the vertical fin "badge" or the national insignias. Send me an SASE for details and prices.

## PREFLIGHT

Before heading to the field, do your homework. It's always a lot easier (and potentially a lot less embarrassing!) if you check everything over at home—at least twice. In addition to having all the materials and tools on hand to make any adjustments, your workshop is "friendly" ground—much less intimidating than the field where it seems that everyone, including guys you haven't seen in years, shows up when you decide to test fly a new airplane! Check the CG. Check that the control movements fol-

# BATTLEFIELD BUDDY

North American Aviation—you know, the folks who brought us history-making airplanes such as the T-6 Texan, the P-51 Mustang and the F-86 Sabre—were also responsible for the OV-10 Bronco; it's a unique fighting machine that has similarly written a place for itself in aviation history.

The concept that sired the Bronco originated with a pair of Marine ground-pounders who astutely recognized the need for an airplane that could live with the troops and provide a wide range of services. Fire suppression, close air support, reconnaissance and any other duties that field commanders deemed necessary to achieve battlefield dominance were the primary objectives. A target price in the area of $100,000 per aircraft was envisioned. This, of course, was in 1959, when one could buy a brand-new Corvette for less than 5 grand. That 1959 Corvette would now fetch what the original Bronco-type airplane was targeted to cost! Times sure do change!

Out of this study grew the Light Armed Reconnaissance Aircraft (LARA) that attracted the interest of no less than nine airframe contractors. After the smoke had cleared, two remained: General Dynamics with their Model 48 Charger and North American (Rockwell) with the NA300. Beacuse of the typical government inability to make a swift decision on *anything*, it wasn't until August, 1964 that North American was declared the winner of the competition. The prototype OV-10 had its first flight less than a year later, in July 1965.

As is usually the case with any military airplane, the mission envelope expands, the payload requirements go up and the loiter times increase, while the performance is expected to at least remain the same, if not to improve. Though the eventual military users would like to have all this happen with no change in cost, size or anything else, it never happens. In the case of the Bronco, the wing grew by more than 30 percent to its final production span of 40 feet; the Garrett T-76 turboprop engines gained a whopping 380 shaft horsepower *each;* ejection seats and armor plate were fitted; and the airplane was made much more likely to survive in the battlefield environment in which it was intended to operate.

Before production of the OV-10 ended in April 1969, it was in widespread use by the Navy, the Marines and the Air Force, and it distinguished itself in Southeast Asia. Some 20 years later, the Marines employed it effectively in the Gulf War. In addition, it was bought by four other countries, including Germany, which made it a real hot rod by fitting a pod-mounted J-85 turbine to the upper fuselage, just aft of the cockpit.

Another modification that added immeasurably to the mission performance of the Bronco was the NOS (Night Observation Surveillance) system, which changed the designation of the OV-10A to the "D" model for the Marines. "Why just look when you can shoot?" might have been the reasoning that changed NOS to NOGS (Night Observation Gunnery System) on some "D" models, adding lethality, in the form of an M-97 20mm gun turret, to an already proven platform.

***A Marine OV-10D with NOS modification for night observation missions.***

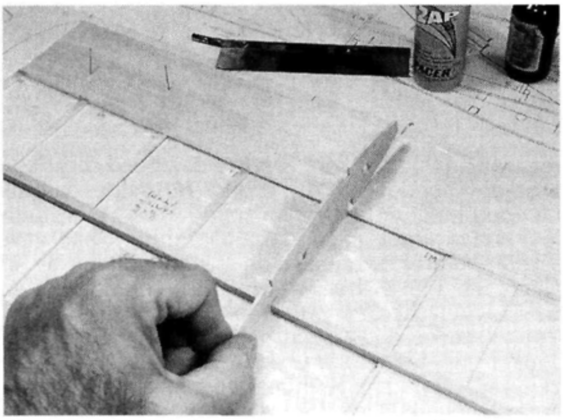
Though never considered to be a "glamour" airplane (even by the very untrained eye!), the Bronco seems to have captured the hearts of those who flew it for any length of time. Although many of the airframes have been retired, the Marines' "D" models are likely to be soldiering on into the next century. NASA operates a few, and the examples currently being flown by the Department of the Interior Bureau of Land Management have had their military warpaint replaced by some very striking, attractive paint schemes.


***The OV-10A assigned to NATC Pax River; highly visible scheme works equally well on the model.***

The OV-10 makes a great R/C model for many of the reasons the full-scale version was so successful: easy to build, simple to maintain, fun to fly. Just hold your ground and resist temptation to add 30 percent to the wingspan, replace the .25s with .40s, thicken the fuselage sides, add a gyro....

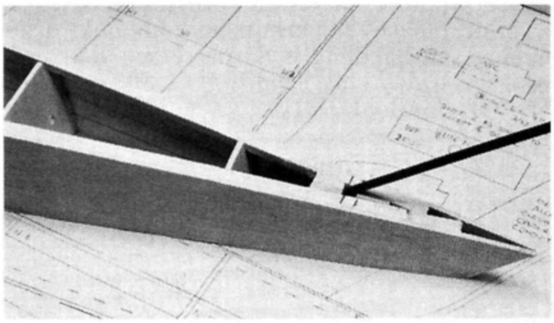
low the stick input; no, I mean *really* check it. You'd be amazed at how many airplanes take off (briefly) with controls reversed!

Finally, run a tank or two of fuel



***After pinning down the leading-edge sheeting, the lower capstrips, trailing edge and both lower spars, add ribs as indicated on the plan. It's easy to build—no dihedral, no washout, constant chord! Don't forget to add the 1/16-inch balsa sub-leading edge!***

through the engines. Become familiar with the starting sequence, needle settings and the sound of the twins running in synch. A tach is helpful, but not essential; there's no mistaking when both powerplants are "talking" to each other. Remember? It's



***The Nyrod pushrod guide for the elevator cable/conduit. When the top of the nacelle/boom has been sheeted, this guide will be cut off flush with the upper fuselage-skin line.***

that very sound that got you here in the first place!

## FLYING TIME

So, we've done everything necessary to make the test hop as painless as possible—no real risk to me here; after all it *is* Rolf's airplane! Mike Gross shows up, Ed has the airplane, and I'm on hand with my camera. Fellow club member Scott is strategically positioned with his video camera to capture the moment!

We decide to do some taxi tests with a little acceleration down the runway to get the feel of it. Everything seems to work OK. Did I forget to mention that the wind is blowing at around 25 knots (but right down the runway!)? Who shows up? Rolf! "You guys aren't *really* going to test fly *my* airplane now, are you?" "Sure; it isn't *my* airplane! Anyway you said you weren't going to be here!"

We fire up the engines, taxi into position, check the gale and go rocketing down (and off the end of) the runway. We conclude that the "deck angle" of the airplane is a skosh on the negative side, so we lengthen the nose-gear strut a bit by taking some of the bend out of it to give the wing a slightly more positive angle of attack.

Attempt number two! This time, the Bronco lifts off cleanly, and Mike proceeds to cruise around the patch, inputting any trim required. The ailerons are extremely effective and a little too sensitive, especially when trying to fight the wind.

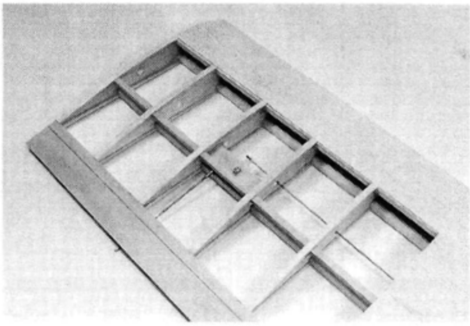
After an uneventful landing next to the runway, we refuel, make some trim adjustments, adjust the aileron dual rates and give it another try. This time, everything goes as planned and, in spite of the high wind speed, the OV-10 performs well. The ailerons are a still a bit sensitive, the elevator is just fine, and the rudders are very effective. Mike lands, taxis back, shuts down and we call it a day.

Rolf's Bronco weighs a hefty 6¾ pounds; mine comes in a full pound lighter; they both fly very smoothly, but the heavier version handles the wind better. Interestingly, with all the flights on both airplanes, neither has yet experienced the dreaded engine-out condition! As my engineering professor used to tell us: "Plan for it, design for it, and it will probably never happen!"

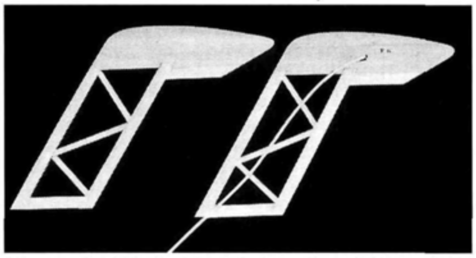
Those of you who tend to build heavy or would just like to lower the wing loading a bit can add an additional "bay" to each wingtip, as indicated on the plans. The appearance isn't compromised at all, and it will offset all the scale detailing you added! Besides, the *real* Bronco had 10 feet (over 30 percent) added to its span when it eventually went into production (see sidebar)!

## WRAP-UP AND REWARDS

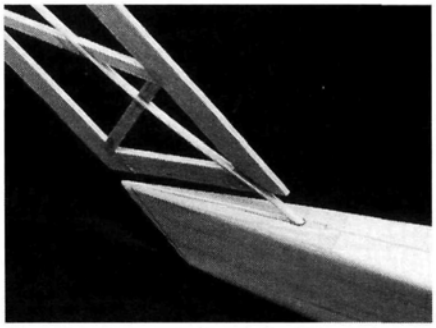
This was a fun airplane to design and build—even more fun to fly. I hoped to



***The upper sheeting, capstrips and leading edge have been installed; aileron bellcranks are mounted on ply plates. The pushrod exit sheeting has not yet been added.***



***The vertical-fin build-up before the addition of the 1/16-inch balsa sheeting; elevator pushrod (cable/conduit) is required on only one side.***



***The elevator cable/conduit slides into and through the Nyrod pushrod guide. A slot will be cut in the nacelle/boom to accept the base of the vertical fin.***

interest modelers who, until now, have avoided building a twin because they had heard all the horror stories about twin-engine models.

The Bronco's size was influenced by my looking at the specifications of a typical .40-powered, single-engine sport model, and I made every effort to preserve the flying qualities of that typical sport model. All I did was power it with a pair of engines in a size that's gaining popularity so more of you will be able to appreciate building and flying a twin. I hope your Bronco provides you with as much enjoyment as I've had bringing it to you. I welcome your comments or suggestions for new designs.

**Addresses are listed alphabetically in the Index of Manufacturers on page 134.* ■

# A Man-Carrying R/C Aircraft?

*To protect the first version of the Raptor while proving reliability of automated and R/C control systems, a "safety pilot" straddled the aircraft and monitored performance (program manager Doug Shane and Mike Melville of Scaled Composites served as safety pilots). The safety pilots had the ability to override and assume control of the aircraft, e.g., if the ground R/C pilots approached a landing too steeply. A streamlined seat and stirrups were added to secure the safety pilot's perch.*


*The unpainted airframe shows exposed, hand-contoured blue foam.*

# The Raptor

by TOM ATWOOD

## A high-altitude UAV emerges from Burt Rutan's Scaled Composites' Skunkworks

**SCALED COMPOSITES, the innovative, full-scale-aviation design and development company founded by famed aircraft designer Burt Rutan, has developed an unmanned aerial vehicle (UAV) named Raptor that, among other things, is designed to destroy battlefield ballistic missiles before they enter space. The project, over two years in development, represents a remarkable marriage of full-scale, composite construction and R/C technologies. As far as we know, Raptor is the first R/C aircraft that has been remotely flown by a ground pilot while a human "safety pilot" sits astride its fuselage!**

*The airframe has been painted, and the cowl has been removed.*

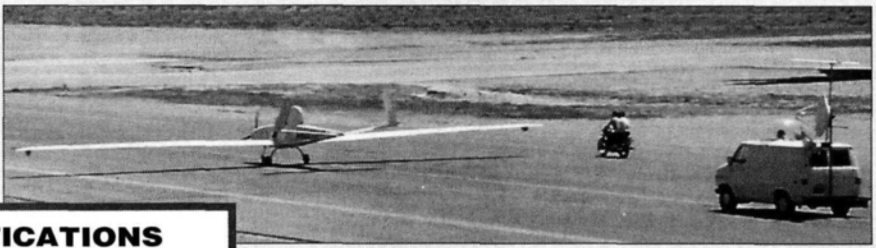
**To get the details, I interviewed engineer and Raptor R/C pilot, Dan Kreigh. Raptor is designed to carry a 150-pound payload, which can be missiles for nailing battlefield missiles shortly after blastoff, or any of a variety of sensors, e.g., reconnaissance and weather-monitoring.**

*The wing is shown upside-down before application of the bottom skin.*

PHOTOS COURTESY OF SCALED COMPOSITES

# RAPTOR DETAILS

The Raptor Demonstrator high-altitude, long-endurance UAV program began with a contract award from Lawrence Livermore National Laboratory to Scaled Composites on June 5, 1992. In order to satisfy rigorous performance criteria of flight up to 65,000 feet and 48-hour+ endurance, a high fuel fraction and lightweight composite structure were necessary.



*The Raptor is on rollout with the ground station (and R/C pilot, in the bubble) close behind. The ground station is affectionately called the "Pope-mobile" because of the Plexiglas cover. Note the precautionary motorcycle chase vehicle; the passenger on the bike would grab the wingtip, if the need arose, to stabilize ground handling. Raptor does not have a steerable nose gear but depends on differential braking for steering at lower speeds. The photo was taken from a chase aircraft.*

### SPECIFICATIONS

**Type:** high-altitude, long-endurance UAV

**Wingspan:** 66 ft.

**Length:** 25 ft.

**Wing area:** 183.8 sq. ft.

**All-up weight:** 2,500 lb.

**Wing loading:** 217.6 oz./sq. ft.

**Propulsion system:**
- low altitude (30,000 ft.): 66hp, fuel-injected 912 Rotax spinning a 4-foot-diameter, 3-blade Cato prop
- high altitude (65,000 ft.): 80hp, modified, 2-stage, turbocharged Rotax spinning a custom-designed, variable-pitch, 14-foot-diameter, 2-blade, all-graphite prop.

**Payload:** 150-pound payload (variety of sensors or weaponry)

**Development budget:** under $3 million

### CONSTRUCTION

The structure used for the Raptor is the same type of composite construction that was used on the record-setting, around-the-world Voyager aircraft. To minimize tooling costs, the fuselage is made of simple slab-sided shapes cut out of flat honeycomb and graphite panel lay-ups. The wings and fuselage are vacuum- and oven-cured prepreg graphite tape with a Nomex honeycomb core. Horizontal and vertical stabilizers and control surfaces all use hot-wired foam-core with carbon cloth skin. The wing and spar molds are made of simple particle-board and sheet-metal.

### PERFORMANCE

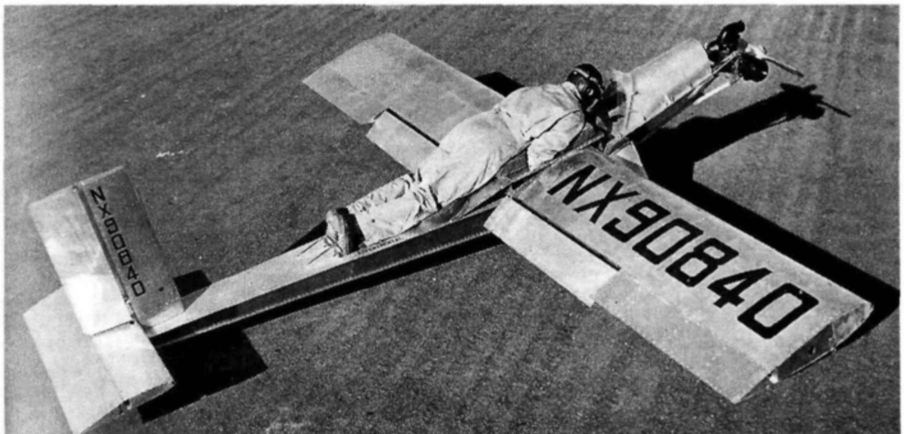
Dan Kreigh observes that Raptor's low-altitude version is designed to fly at 49mph at 30,000 feet altitude to achieve optimal energy savings and maximum duration (approximately 60 hours). Maximum speed is about 80mph. The airplane boasts a lift-to-drag ratio of about 30:1, which is comparable to a number of full-scale glider trainers, and better than the L/D achieved by most R/C gliders.

The aircraft is rather like two airplanes in one. The low-altitude version is powered by a fuel-injected, 66hp, 912 Rotax engine that spins a Cato 3-blade prop. The high-altitude version (65,000 feet) uses a two-stage, turbocharged, 80hp, highly modified Rotax engine. Scaled Composites designed and manufactured a high-altitude, 2-blade, 14-foot-diameter, all-graphite, adjustable-pitch propeller for the aircraft. Currently, all flight testing has been performed with the low-altitude engine and small propeller.

The plane is equipped with an onboard autopilot for over-the-horizon operations. The autopilot consists of a single 486-based controller with multiple analog and digital ports for processing signals from aircraft sensors, and serial ports to communicate with command signal decoders and downlink data transmitters. Position information is obtained from a Garmin aviation GPS receiver that the autopilot uses to fly the aircraft along a pre-programmed flight path. Triple-redundant gyros in all axes ensure stable aircraft control. Thirteen aerospace servos and a variety of electronic switches activate the control surfaces and various onboard systems. Scaled Composites designed, developed and tested all Raptor flight controls, including autopilot, autonomous navigation and emergency-recovery systems (see also "Raptor Details" sidebar).

## OPTIONAL PASSENGER

One of Raptor's unique features is that it's optionally piloted by an onboard safety pilot. The safety pilot was literally an afterthought but became very effective in reducing autopilot development costs. Dan Kreigh notes that "Since the fuselage wasn't wide enough to put the pilot inside, we had to make a 'saddle' complete with stirrups for him to ride on the outside. With the safety pilot on board, the autopilot could be tested and verified in an actual flight environment without risking the aircraft should the autopilot flip a bit. If the autopilot bellies up, the carbon-based, single-channel, backup




***Raptor's ancestor? We don't think so, but we were struck by the similarity of concept with respect to the pilot perched on top of the plane. This tiny airplane was built in 1948 in a garage at Mission Beach, CA, by three young flight research specialists: Kenneth Coward, 27; Karl H. Montijo, 23 (designer); and William F. Chana, 27, (shown on board). With a wingspan of 15 feet, a length of 13 feet and a weight of 150 pounds, it was not much bigger than some giant-scale R/C aircraft. We understand the plane was awaiting flight tests with a 42-inch prop to replace the 36-inch one shown. Called the "WeeBee," the plane has internal controls that the pilot grasps through armholes cut in the fuse. Expected cruise speed was 80mph. Using war-surplus materials, the plane was built in 6 months at a cost of $200. Do any readers have any follow-up information on this aircraft?***

autopilot (safety pilot) can take control." Once the electronics had been proved, the safety pilot became a passive observer simply monitoring autopilot activities. After the reliability of the autopilot had been established, the safety pilot was removed.

The autopilot has three modes: regular R/C flight like a big model, gyro-stabilized R/C flight and autonomous navigation flight using GPS. All landings and takeoffs are done by manual radio control. Dan comments that "The radio-control pilot sits in a van—his head sticking through a Plexiglas bubble in the ceiling—while the van chases the Raptor on the runway during the takeoff and landing phases. At present, landings and takeoffs are not done through remote cameras as are done by other UAVs, but are all performed by direct viewing.

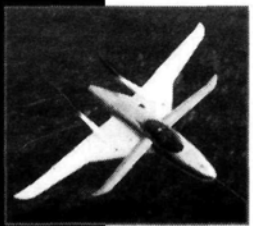
"The remote pilot clutches a conventional Ace Radio joystick box to control Raptor. Generally, once Raptor has climbed about 1,000 feet above ground level, the autopilot is switched to autonomous navigation, from which point the remote pilot simply monitors parameters that are telemetered back from Raptor. After Raptor returns home, the autopilot is switched back to regular radio-control mode. Most of Raptor's flying is beyond visual range from the R/C pilot."

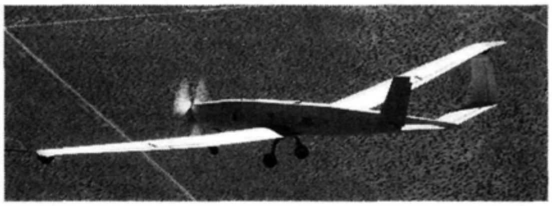
Dan reports that the training required to fly Raptor is not significant. The two

## SCALED COMPOSITES

**Scaled Composites was formed by Burt Rutan, the creator of such well-known aircraft as the Long-EZ and VariEze home-built designs, the Beechcraft Starship and the Voyager (which flew around the planet on a single load of fuel). Scaled enjoys a world-renowned reputation for the design and development of aerospace structures, airfoils and unique aircraft configurations. Under Burt's direction, Scaled has produced or contributed to a host of technologically progressive composite designs including the Ares fighter (with side-mounted Gatling gun), the Pond Racer, the Pegasus winged-rocket, satellite launcher, the aeroshell structure of the McDonnell Douglas single-stage**

**rocket and many more. Scaled is a subsidiary of Wyman-Gordon—a leading manufacturer of high-quality, technically advanced forgings for the commercial transportation and defense equipment industries. Together, Scaled and Wyman-Gordon manufacture and market a wide variety of composite aerospace structures for commercial defense applications. For further information, contact Scaled Composites, 1624 Flight Line, Mojave, CA 93501-1663; (805) 824-4174; fax (805) 824-4541.**





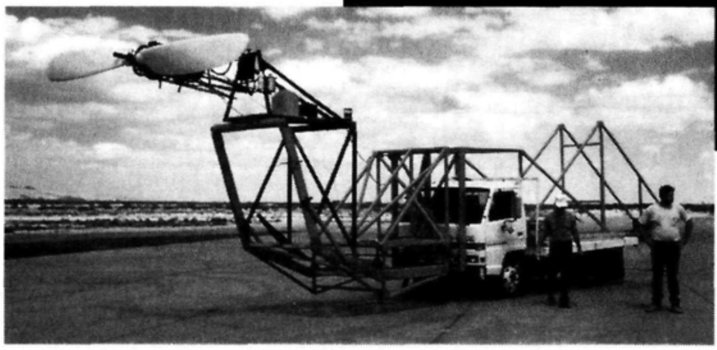
*The Raptor is being flown remotely.*

pilots elected to fly Raptor are high-time, sport R/C pilots and also private pilots. If it had turned out that the R/C pilots could not land Raptor, the onboard safety pilot could always take over. "A private pilot background, however, also helps for radio calls and airport protocol since we are operating Raptor from a controlled airport with normal air traffic (with FAA approval). An instrument rating would also help since we are 'flying on instruments' much of the time."

As it turned out, landing Raptor like a big R/C airplane was not difficult. Dan says everything happened fairly slowly. "The most difficult aspect about controlling Raptor was learning to taxi it. Steering is done through differential braking. Once a yaw rate begins during a turn, rotation of the high-inertia, fuel-filled wings can be tricky to stop, making the taxiing appear jerky and wavering—as if the pilot were drunk."

Sometimes, while the remote pilot practiced approaches, the safety pilot would communicate his comfort level by giving hand signals, any number of gestures, or just waving. Dan quips, "Of course screams were muffled by the engine. The most fun started when the safety pilot came off and we began operating Raptor like a big R/C airplane. We would remotely start it and taxi out, following behind it in the van. Everyone on the ramp would stare at this 66-foot-wingspan airplane taxiing out with no one on board. Of course, everyone stared anyway when the safety pilot *was* on board."

Another interesting scenario occurred when another flight-test operator appeared on the field to fly a full-scale, R/C F-4 Phantom (see "The Doomed Squadron," by Rob Wood, in the May '91 issue of *Model Airplane News* for more on full-scale R/C F-4s and F-86s). This flight-test operator is in the business of converting older military aircraft into drones. Dan recounts that "while we were taxiing out Raptor, they taxied out their F-4 (with pilot on board) and their ground-base control unit, which is a large diesel truck with an array of sophisticated-looking antennas and dishes and a personnel-control module. Here were two, large, radio-controlled aircraft being taxied out with each one being followed by their ground-control units. We waved at each other. It almost felt like old times at the model flying field..." ■



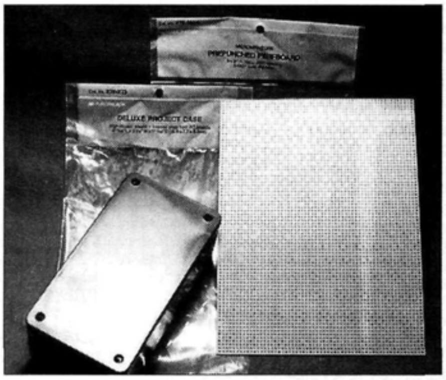
*Scaled Composite's test frame for the high-altitude, adjustable-pitch, 14-foot-diameter propeller.*

# HOW TO Make a Vacuum-Forming Box

by STAFF

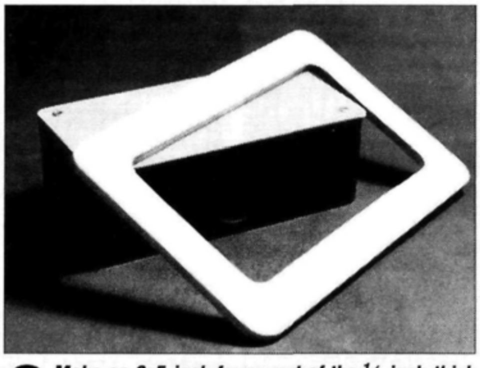
## *An inexpensive way to make parts for your scale model*

AFTER getting past the trainer stage, many modelers want to build an airplane that looks more true-to-scale. All too often, however, many of the scale details on such kit models aren't provided by their manufacturer, but are left to the modeler's ingenuity. Having run into this problem a number of times for such things as air scoops, navigation lights, headsets for the pilot, etc., we decided to make a small vacuum-forming box to reproduce them. The photographs show you how.

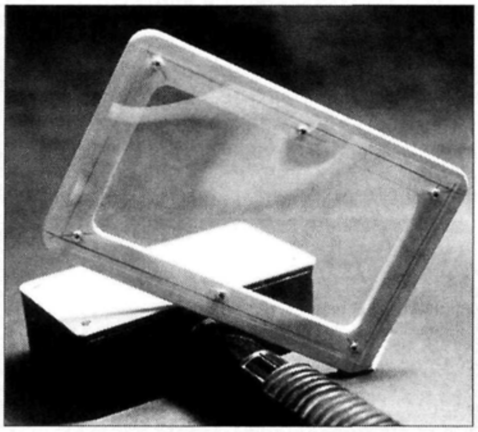



***1** You'll need: Deluxe Project Case, Radio Shack—part no. 270-223; pre-punched Perfboard; Radio Shack—no. 276-1396; 1/4-inch-thick plywood; heat gun; shop vacuum.*

***2** Cut the middle out of the Project Case lid. Cut a piece of the Perfboard to fit on the top of the open box lid. Cut a hole in the side of the case to accept your vacuum hose. This is what your parts should look like when they've been cut and are ready to be assembled. Make the box airtight by gluing the box lid and Perfboard to it with CA.*



***3** Make an 8x5-inch frame out of the 1/4-inch-thick plywood to fit over the box.*

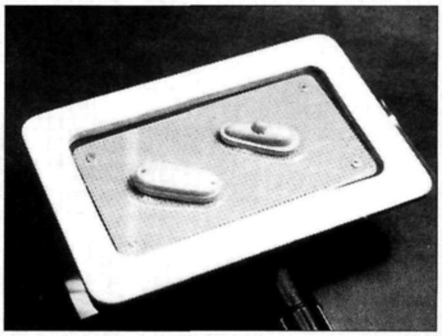


***4** Screw a sheet of 20- or 30-gauge plastic to the plywood frame, and you're ready to vacuum-form a part.*

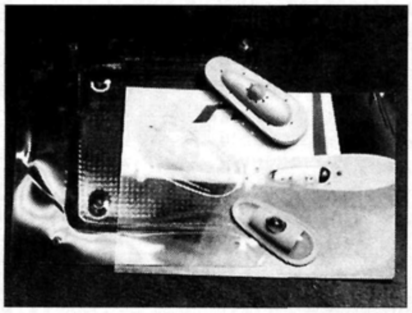
• **Make a mold.** First, you have to make a male mold of the part you want to duplicate. A mold can be made of balsa, hardwood, or foam. The mold doesn't have to be perfect, and there's no need to fill the wood grain. When the plastic is pulled over the mold, any imperfections will be on the inside; the outside of the finished part will be smooth.

When making taller pieces, it can be difficult for the vacuum to pull the plastic completely down over the mold. When this is the case, drill a few small holes in the mold to allow the air to be pulled through. Generally, I find that the molds take less than half an hour to make.

***5** Put your mold on top of the box and, using a heat gun, heat the plastic until you see it start to sag a little. This will take only a few seconds.*



***6** Then turn on your vacuum, lay the frame over the box and watch the plastic "pull down" instantly!*



***7** This shows navigation lights being formed; there's a completed part and one light primed and ready to be painted and detailed.*

• **Final steps.** After you have vacuum-formed the part, pop out the mold, trim away the excess plastic and paint it! This simple system will allow you to make parts of up to 5x3 inches in size. This is more than adequate for navigation lights, instrument panels, pilot accessories, air scoops and some small wheel pants and canopies.

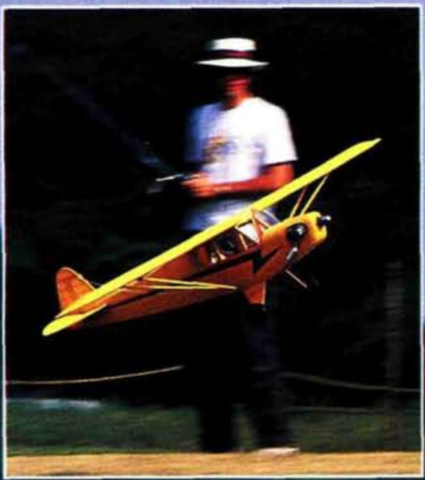
Built for about $10, you will find this vacuum-forming system can really allow you to add some pizzazz to your planes, without extra weight or cost! ■

FIELD & BENCH REVIEW

**I DON'T KNOW** *about you, but the J-3 Cub has always been one of my favorites. So, when Chris Chianelli asked if I would like to review the Kyosho* J-3 Cub, I jumped at the chance. The Cub is the latest in the Kyosho line.*

*When the kit arrived, I couldn't believe how light the box was; I thought someone was playing a joke on me. It was very well-packed, and all the parts were individually wrapped in plastic. The components were of high quality, and the glued joints were well-bonded and very tight.*

*This kit is available in RTC (ready-to-cover) and ARF versions; I received the ARF. The hardware package contains just about everything you'll need, including a very scale-looking landing gear. (The plane comes covered with Cub Yellow fabric. The cowl is yellow ABS plastic, and the landing gear is painted black.)*



*Associate editor Roger Post sets up the Cub for a low fly-by.*

**KYOSHO**

# Piper Cub

by VIC OLIVETT

## Factory-finished J-3 classic

### SPECIFICATIONS

**Name:** Piper J-3 Cub
**Manufacturer:** Kyosho
**Type:** stand-off-scale sport plane
**Wingspan:** 71.7 in.
**Length:** 45 in.
**Wing area:** 760 sq. in.
**Wing loading:** 16.6 oz. per sq. ft.
**Airfoil:** flat-bottom
**Weight:** 5.1 lb.
**Radio req'd.:** 4-channel
**Radio used:** Futaba Conquest FM 6-channel
**Engine req'd:** .30 to .35 2-stroke; .41 to .53 4-stroke
**Engine used:** O.S. .48 Surpass
**Prop used:** Master Airscrew Scimitar Profile 11x6
**List price:** $250 for the covered version; $200 for the uncovered version.

**Features:** strong balsa and lite-ply construction; scale fabric covering that is not available in this country; hardware package; detailed instruction manual; assembled and painted scale-like gear, vacuum-formed windscreen and side windows; plastic cowl; and great looks.

**Hits**
- Strong, warp-free solid construction.
- Scale fabric covering and landing gear.
- Short building time.
- Great flier—very stable and aerobatic.
- Aileron servo-wire pull-strings.

**Misses**
- Needs better strut attachments on the underside of the wing.

PHOTOS BY WALTER SIDAS & TOM ATWOOD

## FLIGHT PERFORMANCE

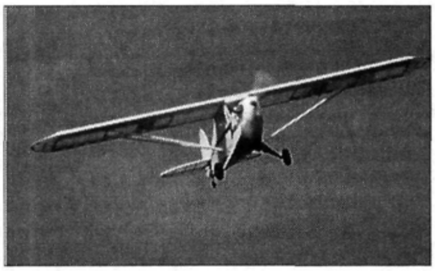
by ROGER POST JR.

*Because I earned my pilot's license in a real Piper Cub, I was curious to see how this plane would handle in scale-like flight. I took the plane out on three occasions in a variety of conditions. As you know, wind conditions and air density can greatly affect a plane's performance.*

*Fortunately, this model has large control surfaces with plenty of throw to overcome any control problems. But I did discover that the elevator throw on this particular model had to be cut down to avoid snapping out of loops. Also, I recommend that you put some differential into the ailerons. This model had the aileron servos glued in (on their sides), so I couldn't change anything. There was plenty of rudder throw for slips and flat turns—fun things to do for scale maneuvers.*

### • Takeoff and landing

The tail came up a few feet into the roll, and during the beginning of the takeoff, I used right rudder and had to gradually increase it throughout the ground roll. On a crosswind takeoff, I added some aileron into the prevailing crosswind, and gradually decreased it as the takeoff speed increased. For a scale-like takeoff, only half throttle was necessary. The O.S. .48 Surpass with the 11x6 Master Airscrew* propeller provided more than enough power for this airplane. On the windy days, I used a little more power. Not quite scale-like performance, but it enabled me to fly the plane.



During the climb-out, I held in the right rudder, and the plane tracked beautifully. Dave Baron and I noticed that, for coordinated turns, rudder input was very critical. Too much—the model skidded; not enough (which seemed like the right amount) and the model slipped. After some experimentation, we finally nailed down the correct amount of rudder for a coordinated turn. This can't be standardized, because every plane and its rudder surface deflection (and the agility of the pilot's thumbs) is different. My advice?—experiment.

Landings and crosswind landings were extremely easy. All I did was drop the throttle to idle, input some up trim to shallow out the descent, line up with the runway and flare just before touchdown. During the crosswind landings, I put some aileron into the prevailing crosswind, applied some opposite rudder, flared before touchdown and landed the plane on the main upwind wheel and the tail wheel—just like a full-size tail-dragger. Increase the aileron input as the plane rolls out and loses speed. The Cub has plenty of rudder authority to correct any misalignment that might occur.

Wheel landings can be accomplished as well; just set the flight attitude for a tail-high landing, and control your descent with power.

Probably, the most fun you'll have with this plane is slipping it on final approach.

### • High-speed performance

Although the Cub is not meant for high-speed flight, I did open up the .48 Surpass and let it rip. Well, it was more like a mild tear, but under full power, the Cub was able to perform all the maneuvers in the book. The two-piece, bolt-on wing can really take some abuse. The struts are not functional, and they need a better method of attachment to the underside of the wing.

The Cub climbed like crazy on a high-speed (power-on) stall attempt and then eventually fell forward and started to fly again. The best thing to do is let go of the stick, and let it fly itself out of the stall.

### • Low-speed performance

During low-speed flight, the Cub is in its element. I tried low-speed flight on both calm and windy days and found that a power setting of ⅓ throttle or less, with the necessary up-trim input, produced scale-like performance. The plane was at a crawl in the sky and was a real pleasure to fly. Dave Baron and I took turns seeing who could do the best scale-like takeoffs, patterns and landings. We barely touched the controls; every input was within a millimeter or two of the neutral position of the sticks.

Low-speed stalls were predictable. The plane barely stalls, and it has a shallow drop-off. The best recovery is to add power and neutralize the elevator. In both the high- and low-speed stall, this Cub would only break to a side if it was pushed by a crosswind. Remember to use small stick inputs to achieve scale-like flight.

### • Aerobatics

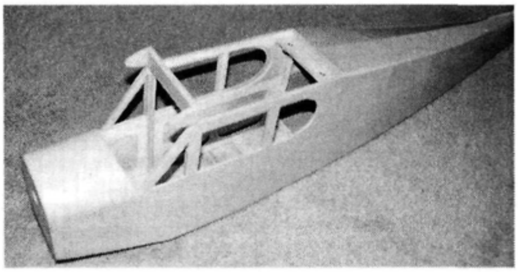
This plane does beautiful slips, flat turns, spins, loops and wingovers/stall turns—just like its full-size counterpart. I upped the power input and was able to do rolls, slow rolls, snaps, Lomcevaks, avalanches, flat spins, inverted flight, inverted spins and all of the other fun stuff in the book. Believe it or not, this Cub will even do a great knife-edge. All you need for aerobatic maneuvers is an adequate amount of control throw and a strong power source to pull the plane through.

## WING

I started with the wing, which consists of two separate panels. The ailerons are hinged with fabric hinges and thin Zap.

***This photo shows the servo-wire pull-system in the wing. It saves time and effort when you feed the wire down the tube.***

Each wing has its own servo, and openings have been cut for easy servo installation. And get this: they even had the foresight to place a pull-string in the panel to pull the servo wire from the servo opening to the wing root. When the servos have been installed, the hatch covers can be cut to fit your servo arm. The covers can then be fastened with four screws. Standard rod and horn linkage comes with the kit.

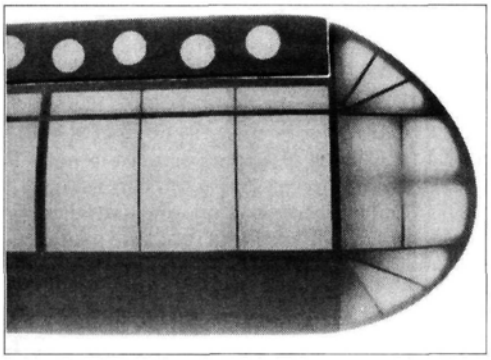


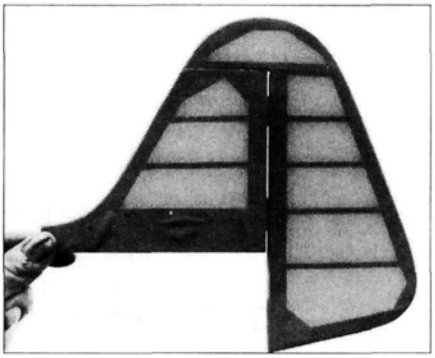
***Out of the box, the fuselage is straight as an arrow with high-quality construction and covering.***

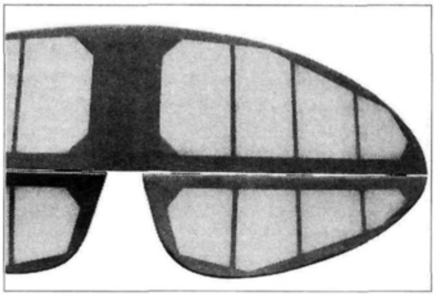
## TAIL

The tail is fairly simple to install, because the slots have already been cut in the fuselage. Carefully remove the covering from the vertical and horizontal stabs at the glue joints, and save the little pieces of fabric, because extra covering is not included.

***I upped the power input and was able to do rolls, slow rolls, snaps, Lomcevaks, avalanches, flat spins, inverted flight, inverted spins and all of the other fun stuff in the book.***







*The sun illuminates the balsa frame through the covering.*

The horizontal stab slides in from the side of the fuselage. When the stab is in place, slide the vertical fin into place. Use a small square to align the vertical fin at a 90-degree angle, then use medium Zap to glue the fin to the stab.

The next step is to install the hinges for the elevator and rudder. The tail wheel is screwed to the bottom of the fuse before the rudder is attached. The elevators use a split pushrod, so there is no joiner wire.

## FUSELAGE

I decided to use an O.S.* .48 Surpass. The engine mounts in the kit are easy to drill, and the position of the engine should be measured to obtain the proper placement from the firewall to the front of the cowl. An easy way to do this is to fasten the cowl to the fuse with tape, and measure to find the correct position on the mounts.

Next, tack-glue the engine in the correct position on the mounts. Stand the fuse on its tail post, and position the mounts so the engine centers in the hole in the front of the cowl. When the engine and mounts are in place, drill holes for the four 4x16mm capscrews and blind nuts. I like to use Loctite* to secure the bolts and blind nuts.

The standard 8-ounce tank is wrapped in foam and placed inside the cabin. I suggest that you install an external fueler, rather than try to remove the fuel line from the carb each time you fill up. Mark the position for the throttle pushrod for the engine you are using in the firewall, and drill through the firewall, taking care not to drill into the fuel tank.

The lower side of the cabin has a slot on each side. These are for the aluminum plates that will later be used as strut attachments. A 3x6mm screw fastens the plates to the fuselage.

The landing gear will be installed in the grooves in the bottom of the fuse. Use a sharp knife to cut a slit in the covering along each groove, then use silicone to seal the opening and install the landing gear. Mark the holes for the hold-down plates, drill the pilot holes for them, and secure the landing gear with eight 3x8mm screws. Wipe away any excess silicone. The landing-gear covers can now be epoxied into place.

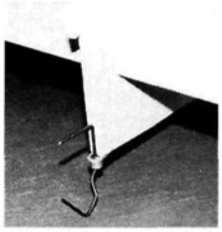
The windows are easy to glue into place, because they're molded to fit inside the frames. I used Formula 560 canopy glue from Pacer*. This glue dries clear and will not distort the windows.

The cowl is held in place with four screws. These are fastened to hardwood blocks that are epoxied to the firewall. The kit supplies clear plastic to reinforce the inside of the cowl. I found that an old no. 11 blade heated with a propane torch worked well for cutting holes in the cowl. I then used 200-grit paper to smooth out the rough edges.

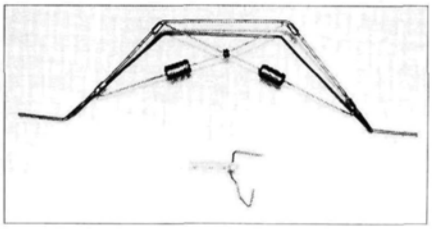
## RADIO INSTALLATION

The Cub uses a 4-channel system with five servos. The elevator uses a split pushrod. The instruction manual shows how to drill the wooden pushrod and fasten the steel rods using CA and a shrink boot, which are provided in the kit. Be careful not to scorch the shrink boot when you heat it.

Epoxy the servo rails in place, and install the servos. I used Du-Bro* quick connectors on the servo arms. On the wing, you'll need a Y-connector to plug the two servos into your aileron channel. I found that with the battery under the tank and the receiver just in front of the servos, the center of gravity (CG) was fine. If you use a 2-stroke .40, you may want to place your battery farther back. Set up the control surfaces as recommended by the manufacturer: the elevator—20mm up and down; the rudder—25mm left and right; and the ailerons—10mm up and down. The CG should be 70mm from the leading edge.



*The horizontal stab, vertical fin and tail-wheel bracket have been installed.*



*The landing gear has a very scale-like appearance and is easy to install. The tail-wheel bracket and the wire that inserts into the rudder function as a third hinge.*

## FINAL ASSEMBLY

The wing struts required some work. I found that the blocks in the wing (into which the wing strut attachment screws go) were too small to be drilled properly. I made small cuts in the covering so that I could install larger blocks in the wing. I then used the pieces of covering that I saved from the stab to repair the incision. The struts are attached to the wing with 2x8mm screws, and the lower end of the strut is fastened to the fuse with a 3x9mm machine screw and nut.

The wing halves are joined by the two aluminum tubes that come with the kit. Use a rat-tail file to enlarge the holes if they're too tight, but remember, the tubes should fit snugly. In the kit, you'll find a piece of clear plastic with two holes; use it to reinforce the trailing edge under the wing hold-down bolts.

When you have checked and re-checked your work, you can charge your system and get ready for some real fun.

** Addresses are listed alphabetically in the Index of Manufacturers on page 134.* ■

HOW TO

by JIM SANDQUIST

*What do you do when you need special color decals for a particular model? You can have them commercially produced, but if you want to save a few bucks, you can make the decals yourself with an office color copier!*

# Make Custom Color Decals

## *A quick and easy solution*

ALL TOO OFTEN, we find an airplane that we want to replicate, but then discover that decals aren't readily available. We could have decals custom-made by one of the commercial sources, but this can sometimes cost more than we want to spend.

With the color copiers now available in many offices, you can make good-quality decals for your aircraft quickly and easily. Color copiers use a very thin, coated paper that works very well as a decal when applied directly to a model. A clear coat is all that's required to protect it from fuel.

*The process is quite simple:*

• Get a photograph of the logo or artwork you want to duplicate as a decal for your model. It will help greatly if the original photo is larger than the size of the decal you want to apply to your plane. When the color copier reduces the original, the definition of the final decal will be greatly enhanced.

• When you have your color copy in the correct size, cut it to shape and simply glue it to the airplane with a very thin coat of Pacer* Z-56 or aliphatic glue.

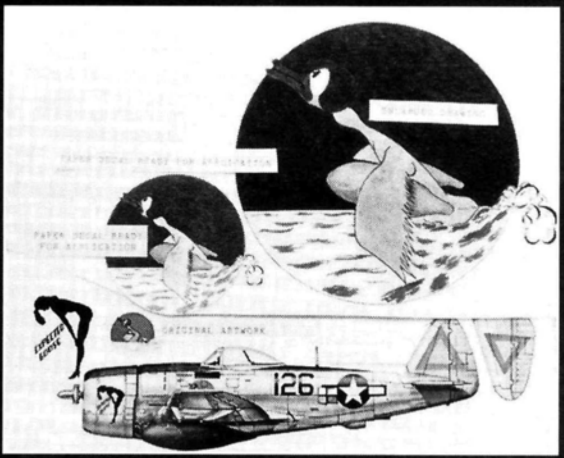
• After the glue has dried, spray on a coat of clear enamel. On a MonoKote* finish, you can seal the decal down with an overlay of clear MonoKote.

That's it! I used this technique to make the Red Baron Pizza decal for the tail of my ¼-scale Super Stearman and the nose art on my latest P-47 Thunderbolt. Give it a try; you'll like the results.

*Addresses are listed alphabetically in the Index of Manufacturers on page 134. ■


*Above: the original artwork; Top: the color photocopy. Reduced to the proper scale size, the copy is of very good quality.*


*"Seal coated" and applied to the airframe, the decal looks great. The words "Stearman Squadron" were hand-painted before the Baron Pizza logo was applied.*

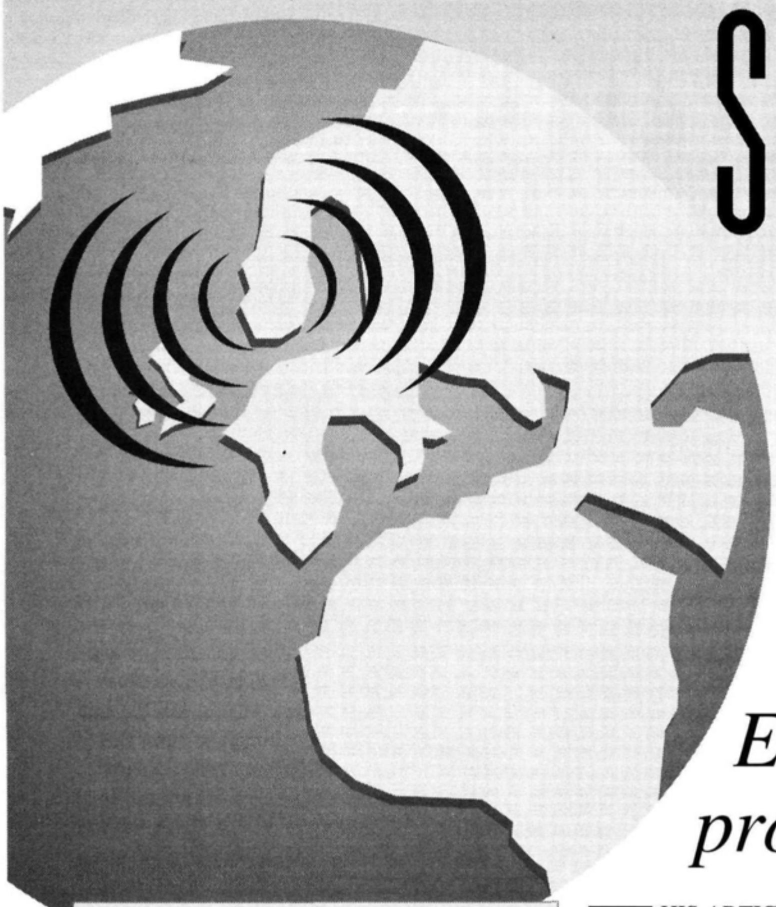



*Here's another example of the artwork and the final decal before it had been applied.*

*Me and my completed P-47. The decals were applied to the model's MonoKoted surface and then covered with clear MonoKote to protect and fuelproof them.*

# Sound Advice from Europe

by TORE PAULSEN ILLUSTRATIONS BY CHRIS MENDOLA



## *Engine noise—problems and solutions*

## EDITOR'S NOTE

*Tore Paulsen has been modeling—with great success—for more than 50 years. Competing with his stand-off-scale "Spitfire" in pattern, he was twice Norwegian national champion. He also flew F-86 Sabres in the Norwegian Air Force and has even built his own aircraft. His latest creation is a scratch-built turbine model jet that's based on a German design.*

THIS ARTICLE is for average modelers who operate a sport, scale, or pattern airplane or maybe run an R/C car or boat. Racing airplanes—ducted fans or similar—require more work to silence, but the principles described in this article apply to most. My "silencing" work started about 20 years ago. It was when the Merco .49 came out with a bolt-on muffler (similar to present expansion mufflers, it helped a little), but we were still losing flying fields because of noise complaints. Like everybody else, I thought that if we could develop an effective muffler, the noise problem would disappear; so I made dozens of mufflers, but my airplanes were just as noisy as ever.

I knew I needed a more scientific approach. I studied every book I could find on the subject and visited technical institutions, etc., and I started to understand the physics of acoustics. But I'll keep theory to a minimum and concentrate on the "how to" and hardware. In 1993, this magazine ran a series of articles on noise (July and August: "Reducing Engine Noise," by Denny Atkins and Ray Abadie; September: "Aerobatics—Quieting Your Airplane," by Dave Patrick); some contained information with which I don't agree, but if you read the articles, you'll have an idea of the problems involved in assessing and quieting noise.

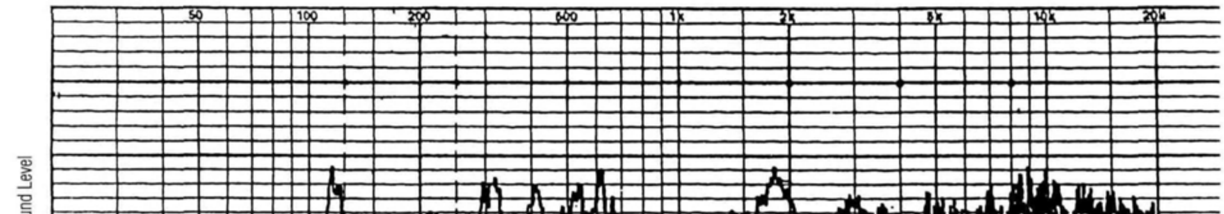



***Figure 1A. Sound analysis of the exhaust from an O.S. .48 Surpass 4-stroke engine running at about 7,500rpm. (I can not explain the low sound of 1000Hz.)***

If, as you read this, you get the feeling that you've read it before, you might have. In '71 and '72, I was chairman of the CIAM (Committee for International Aeromodeling) noise subcommittee, and I submitted a technical paper containing the information I give in this article. It wasn't published because interest in noise reduction was too low. At the 1977 World Championships in Springfield, IL, Carl Goldberg told me that he would like to sell my muffler, but it was at least five years ahead of its time.

## SOUND AND NOISE

Sound is a vibratory disturbance in a medium—in our case, air—and it spreads out (like rings in water) at, of course, the speed of sound. Noise can simply be defined as unwanted sound. To us, a sweetly running engine is music, but it might irritate the neighbors.

We're ready to establish the first rule of noise reduction: get friendly with the neighbors near your flying field! Invite them to meetings; explain the hobby and what you're doing to reduce your models' sounds; establish mutually agreed flying times; let the kids fly or taxi your models, and so forth. If you establish a friendly relationship with those who live near your flying field, they'll perceive your models as being less noisy. Caution: one loud model can destroy this relationship, and after that, even a glider may not be tolerated.

• **The loudness, or amplitude, of sound** is measured as a pressure on a specified area, such as the human ear, which can receive a wide range of sound pressures (whispers to jet-engine roars) in a non-linear way.

Sound-measuring equipment is calibrated in decibels (dB) on a logarithmic (Lg) scale; a whisper would register 0dB, and a noise that hurts would register as 120dB. It's important to understand that the human ear doesn't register sound linearly, and if there's more than one sound source at any time, you'll hear only the loudest sound. If you're at an airport watching jets start up or idle, and your friend tries to tell you something by yelling into your ear, you won't be able to hear him, but if the jet shuts down, his yelling will suddenly hurt your ear. This is important, because our models emit sounds from several sources, so if you manage to silence the exhaust, you'll suddenly hear the propeller—the next loudest sound—and so forth. It also means that you can't add or subtract decibel figures in the usual way; for example: two engines that would each register 90dB will produced a combined reading of 93dB on the sound meter.

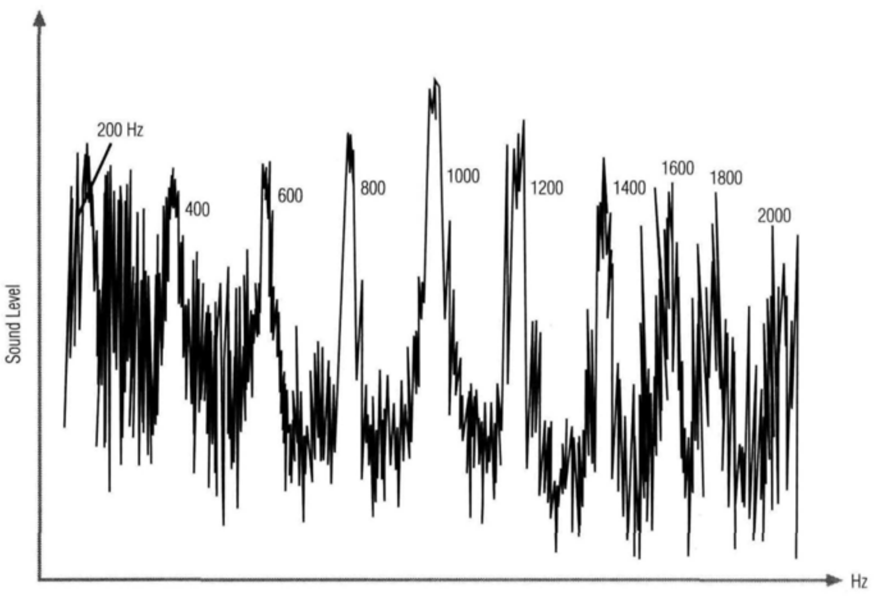



***Figure 1B. Sound analysis of the exhaust from a Webra .61 speed engine at 12,000rpm. The analysis was ended at 2000Hz, but sound continues to rise way above the hearing limit.***

• **The frequency of sound waves** is recorded in Hertz (Hz), or cycles per second (C/S). An engine running at 12,000rpm will have a sound frequency of 200Hz (12,000 ÷ 60 = 200Hz).

The ear does not receive all frequencies equally well. It is most sensitive to frequencies between 1,000 and 5,000Hz. To make a sound meter receive sound over this spectrum, filters are installed in it; an "A" (acoustic) is added to "dB," to denote that sound is being measured in this way, i.e., is being passed through a filter; meter readings are then expressed as "dBA."

Sound meters also have two settings: slow and fast. A slow setting damps the reading so that the meter's needle doesn't swing wildly, as it could if it were measuring the noise of a pneumatic drill. The damping effect of the slow setting averages out the meter's response to sound. For this reason, with pulsating sounds, a meter set at the slow setting may miss single peaks. Both the slow and fast settings can be used to measure a static model airplane running at steady rpm, but to measure in-flight sound, the fast setting must be used.

• Sounds may be characterized by the shape of their waves—sinusoidal (like a sine curve), square, or triangular. A mixture of these wave forms, such as that registered by the sound of a heavy-metal band, will make a complex shape. A soft flute tone will be sinusoidal. Our model airplanes emit a complex wave form (see Figures 1A and 1B).

• **Harmonic content.** With the exception of a pure sinusoidal wave, all sound waves contain a fundamental pitch, undertones (lower frequencies) and overtones (higher frequencies). Expressed in hertz (1 hertz—1Hz—is equal to one cycle per second) in multiples of the fundamental pitch, these overtones are called "harmonics."

Sharp-edge wave forms contain the highest number of harmonics. This is clearly shown in Figure 1B, which is an engine running at 12,000rpm or 200Hz. (Note that the sound readings given are all multiples of 200Hz.) For us, getting rid of the fundamental pitch sound frequency is very difficult; it requires the use of large mufflers and inefficient, multi-blade propellers. Fortunately, most of the sound from a model airplane comes from harmonic overtones (higher frequencies), which can be tuned out by smaller mufflers. This leaves only the basic (low) frequencies—primarily determined by engine rpm. We then hear only a quiet buzz from our models and not the screaming (high frequency) we're used to.

## MEASURING SOUND

Sound (and noise) decreases with distance.

• With every doubling of the distance from the source of the sound, the sound is reduced by 6dB.

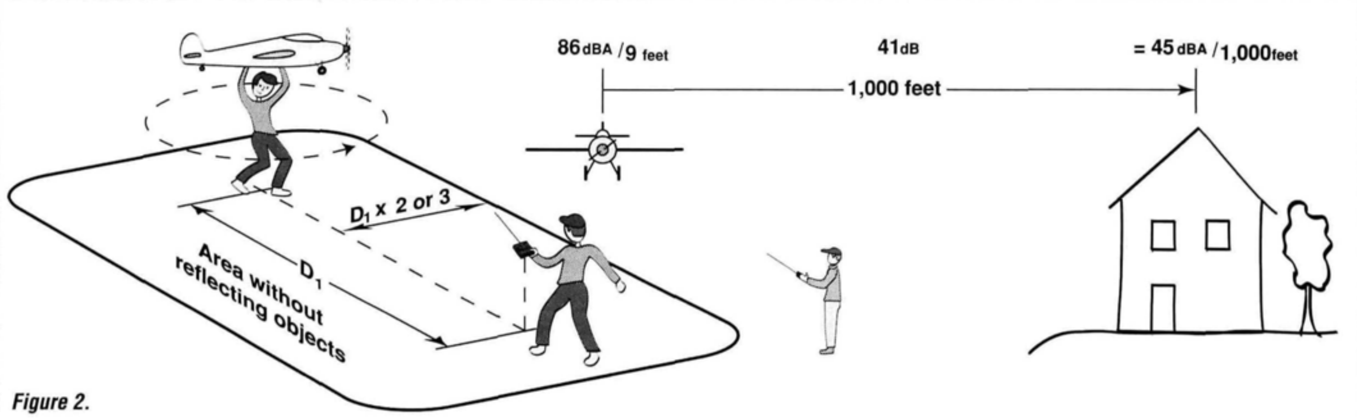



Figure 2.

Measure a sound 9 feet away from its source; at 18 feet, readings will be 6dB less; at 36 feet—12dB less; at 72 feet—24dB less, and so on.

*Expressed mathematically, this is:*

$$\text{dB reduction} = 20 \times \text{Lg} \frac{\text{Distance (D2)}}{\text{Measuring Distance (D1)}}$$

It's generally accepted that sound levels in housing areas should not exceed 45dBA.

• **Are you annoying the neighbors?** Look at Figure 2. Measure the distance from the air space in which you fly your models to the nearest house. Let's say that it's 1,000 feet (D2) and that you measure the sound from your models at 9 feet (D1).

$$\text{dB reduction} = 20 \times \text{Lg} \frac{1000}{9} = 40.9\text{dB} \approx 41\text{dB}$$

Maximum sound level at the housing area should be: 45 + 41 = 86dBA

This will be the maximum sound level for your field, when measured at 9 feet. Note that the "A" refers to frequency only and not to sound levels.

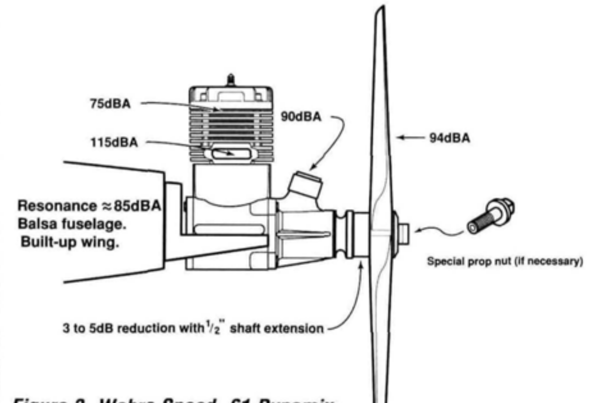



*Figure 3. Webra Speed .61 Dynamix carburetor; 1,200rpm with super M11-7 prop measured at 9 feet.*

I was chairman of the CIAM noise subcommittee when measuring methods were discussed. It is impossible to make accurate measurements without a laboratory, so the method now used by both the AMA and the FAI was designed to give a quick and reasonably accurate sound-level check at contests.

To check the sound level at your field with the aim that sound at the nearest house should not exceed 45dBA, this method is completely useless; there are too many possibilities for error. At our field, we tested different methods and came up with the method shown in Figure 2. One person holds the model as high as possible over his head and rotates it slowly 360 degrees with the throttle fully open. The dB meter is hand-held at shoulder height. The person measuring should wear soft clothing to avoid reflecting sound and stand at 90 degrees to the measuring line—again, to avoid reflecting sound from the chest. The test range should be permanently marked and in a quiet corner of the field.

This method has proven to be accurate when checked at the proper distance. When testing starts, the wind should be almost calm—reading no more than a maximum of 20dB below the noise limit. Measure at least 15 feet away from the model to avoid small distance errors giving inaccurate readings (9 feet is too close). On the test range, there should not be any sound-reflecting objects within 30 to 45 feet of the model.

• **What's making the noise?** Having dealt with the basic physical properties of sound/noise, I was ready to start on the hardware. But before starting to cut metal, I had to know from which parts of the model the sound was coming.

Figure 3 shows what I discovered. The values are only valid for the conditions shown. Other engines, propellers and models will give different results, but they should be in the same area. I spent a whole summer making test stands and other equipment. I will not go into details about the testing procedures; you'll just have to believe me, but to give you an idea of what it takes to measure exhaust sound: all other sound sources must be eliminated; the propeller must be replaced with a braked flywheel; the carburetor must be connected by means of a heavy rubber hose to a large muffler; and the engine must be mounted on a very heavy test stand.

You can now understand why muffler noise test results obtained with the engine pulling a propeller and without any reference to rpm or distance are without any value.

We will now examine each sound source and build the hardware to deal with it. It must be remembered that the object is to reduce all sounds with frequencies between 1000Hz and 5000Hz. These harmonic overtones give our models their screaming sound.

## EXHAUST SOUND

This sound is caused by the sudden release of high-pressure gas. Four-stroke engines are a little more quiet, because the gas, when released, is of a lower pressure. But if you increase the power of a 4-stroke engine, it will quickly be almost as noisy as a 2-stroker. The burning rate of gas in the cylinder is almost constant, so if you have an engine with a short stroke, it will be noisier than a long-stroke engine, because the gas is released at a higher pressure. For this reason,

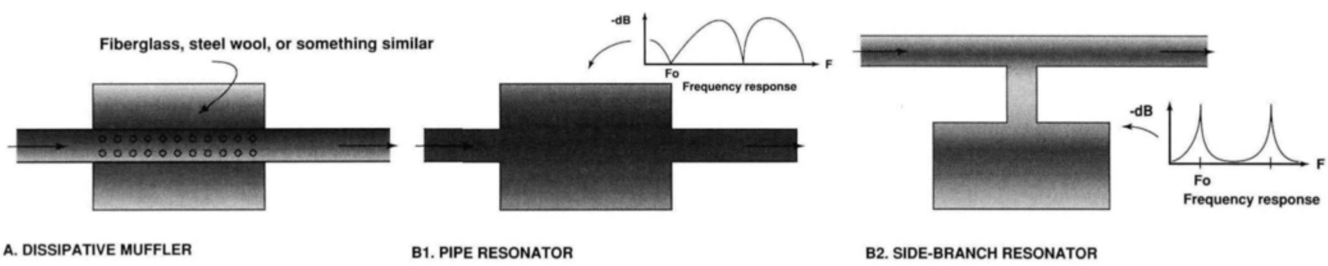



*Figure 4.*

an unmuffled Cox .049 has a sharp exhaust sound. In 8 years, the only complaint we heard at our field was over an unmuffled Cox .049. Diesels are quieter because most of the fuel has been burned by the time the exhaust port opens; all my engines are diesels. It is no problem making a muffler that reduces sound by making it so restrictive to gas flow that the engine loses power and thereby produces less noise. Most commercial mufflers are designed this way.

Generally speaking, there are only two types of effective muffler:

• **Dissipative muffler.** This consists of a straight-through pipe that has a number of holes drilled in it and is surrounded with fiberglass, steel wool, or another absorptive material—all contained in a chamber through which the pipe runs. The sound energy is absorbed mechanically by the absorptive material. This type of muffler isn't suitable for model engines because the holes quickly get clogged by the high oil content in the exhaust.

• **Reactive muffler.** This consists of a number of chambers and pipes that present a mismatch in terms of size and length in relation to the frequencies involved, and the sound energy is reflected back and forth within the muffler and is consumed there. There are two types: the pipe resonator and side-branch resonator. Auto mufflers are usually a complex combination of these mufflers. Figure 4 shows these mufflers in their simplest form.

During my many experiments, I found the pipe resonator to be the most suitable—both for performance and simplicity—so I will discuss this muffler in detail. It has one resonant frequency (Fo) and damps sound by 12dB each time the frequency is doubled (1 octave) above Fo. All chambers and pipes will have standing waves when the physical length of the pipe or chamber is an integral number of half or whole wavelengths of a frequency.

When a standing wave occurs, the sound reduction is greatly reduced. You can deduce from this that the chamber and pipe should be of equal lengths, so that we have only one set of bandpasses and not one for the pipe and one for the chamber. To be exact, the acoustical length of the inner pipe(s) should be 0.4 x diameter, so any excess length should be cut off at the far end (see Figure 5A). If we push the pipe exactly halfway into the chamber, the half-wavelength bandpasses are canceled, and we are left with only whole-wavelength bandpasses; this greatly improves the muffler's performance. It is like a musical instrument in reverse, so the muffler must therefore be built accurately.

This may sound confusing, but if we design a pipe resonator muffler for a .40 2-stroke engine, it should be more understandable. First, the chamber volume should be at least 10 times the cylinder volume. It is best to make the muffler short and fat, so the first bandpass will be high in frequency; but the muffler should also be streamlined, so I selected a diameter of 1.25 inches.

**Formula 1.**

$$(1.25 \div 2)^2 \times \pi \times 3.25 = 3.98\text{ci}$$

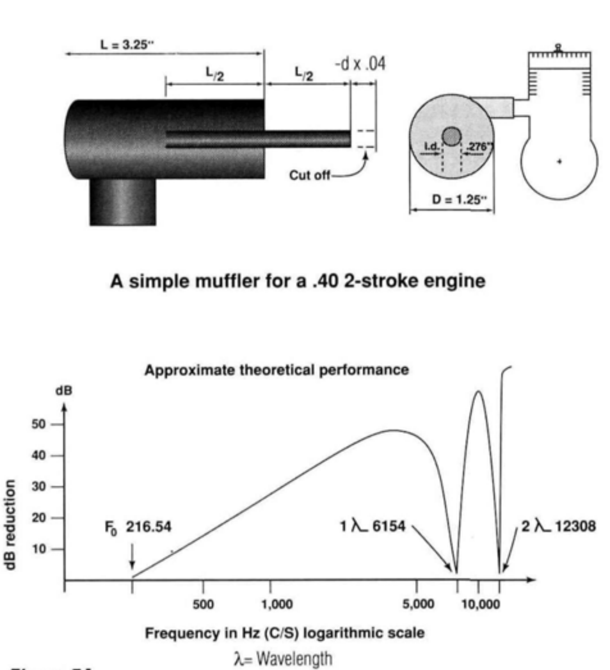



*Figure 5A.*

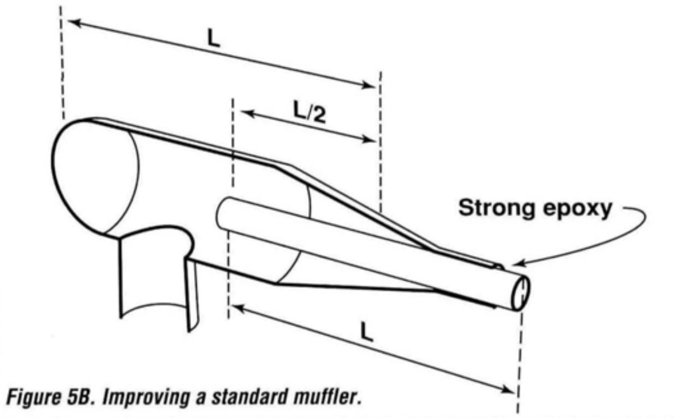



*Figure 5B. Improving a standard muffler.*

So the length of the pipe and chamber should be 3.25 inches.

The pipe's inside diameter determines the backpressure, and a formula has been developed, by trial and error, for this diameter (except when otherwise stated, all dimensions are internal dimensions).

**Formula 2.**

Pipe diameter in inches =

$$\sqrt{\frac{\text{cylinder volume x RPM}}{63{,}012}}$$

For our .40 engine, the pipe diameter comes out at 0.276 inch. We can now calculate the frequency performance of this muffler. The Fo where there is no dB reduction is equal to:

**Formula 3.**

$$\frac{a}{2\times\pi} \times \sqrt{\frac{A}{V \times L}}$$

a = speed of sound in hot exhaust gas (about 20,000 inches per second);

A = cross-sectional areas of pipe: $(0.276 \div 2)^2 \times \pi = 0.0598$ sq. in.;

V = volume of chamber = cylinder volume x 10 = 4ci;

L = 3.25 in.;

$$Fo = \frac{20.000}{6.28} \times \sqrt{\frac{0.0598}{3.98 \times 3.25}} = 216.54\text{Hz}$$

At what frequency will we have the first standing wave with the reduction of performance? The length of the pipe and chamber is 3.25 inches. At what frequency is 3.25 inches equal to one wavelength?

**Formula 4.**

$$F = \frac{1 \times a}{L} = \frac{1 \times 20{,}000}{3.25} = 6154\text{Hz}$$

The next bandpass (two wavelengths) will occur at 12,308Hz, and so forth. It should be a good muffler because we have covered the frequencies from 1000Hz to 5000Hz, which are the most irritating to the human ear.

The exhaust inlet can be anywhere on the muffler, but its long internal pipe(s) can rob the engine of some power. Later in this article, I'll show you how you can connect it with a mini-pipe and increase rpm by 1,000.

The muffler and the performance chart are shown in Figure 5A. A standard expansion muffler has poor sound-reduction performance, because, although it has an expansion chamber, there is no internal pipe, or just a very short one. By just adding a pipe, you can greatly improve its performance. Figure out the diameter you need (Formula 2), and drill out the outlet to fit the pipe. Then push the pipe halfway into the muffler, and glue it with a strong epoxy. If there is not enough material to drill out, you can try a pipe with a smaller diameter (Figure 5B). For small engines, this may be *the only step required* to bring down the sound to an acceptable level—little cost or work. I'll explain how to make a muffler later.

## VITAL PIPE RESONATOR

The reason for going into such detail about the pipe resonator (Helmholz chamber) is that this is the building block for more complex mufflers, and it will also enable you to experiment with mufflers, or custom-build one to suit special needs. There are numerous ways to use the pipe resonator or the side branch, and some examples are shown in Figure 6. For more details, I will refer to Beranek, *"Noise and Vibration Control,"* (McGraw-Hill). You will see that, by varying the chamber and pipe, you can design mufflers to suit special frequency needs.

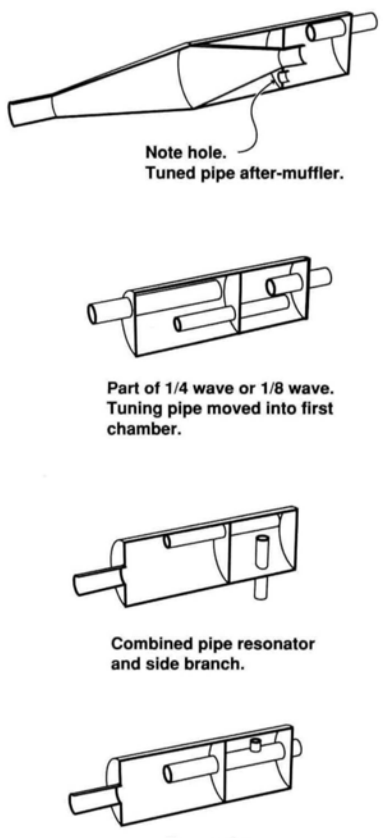



*Figure 6. A few suggestions for different mufflers.*

If you want more sound reduction than the single pipe resonator can give, you need a second chamber and pipe. You'll probably need them for .40 2-strokers and upwards. By making the second chamber and pipe L x 0.666 inch shorter than the first but maintaining its diameter, you'll achieve a staggered effect, so that when the first chamber has a bandpass, the other chamber will have a peak, giving high reduction of sound over the entire frequency range. I have measured a reduction of over 30dB (compared with

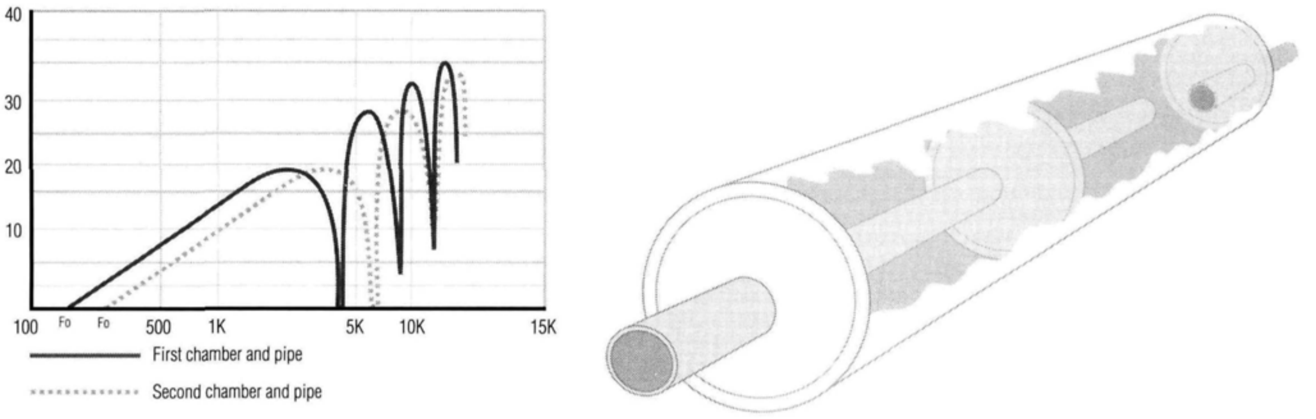



*Figure 7. Sound frequency; KHz logarithmic scale; "TP" muffler performance.*

open-exhaust readings).

I sent a .60-size muffler to *Model Airplane News* to be tested by David Gierke, but he was unable to achieve exactly the same result. I do not have all the details and data of his testing, but it is very easy to get inaccurate results when measuring sound. As mentioned earlier, I spent a whole summer on obtaining consistent results. To test accurately, it's best to mount such a muffler, do the other steps required, and compare your model with others in flight.

Well, back to the muffler. I call this two-chamber muffler the "TP" muffler. Its general layout and typical frequency response are shown in Figure 7. Figure 8 shows the required dimensions—in millimeters—of mufflers in three sizes (in millimeters, to avoid my making mistakes when converting to inches; to convert to decimal inches, divide by 25.4). (Diameters aren't critical; only lengths are.) In Norway, thin-wall brass tube is available in all sizes; in the U.S., you have to look for thin-wall, 0.02-inch, brass or soft-steel tube.

Without going into tuned-pipe theory, I will just give you the length-versus-rpm formula for a normally timed engine. (These lengths are approximate.)

- A tuned-pipe length of 10.7 inches will allow 10,000rpm.
- Minus 1 inch = 1,000rpm increase.
- Plus 1 inch = 1,000rpm decrease.

You also have to test-fly your airplane in flight. If the pipe is too short, you will have high static rpm, but the engine will run hot and burn plugs in flight. If it is too long, the engine will just stutter and never run right. If it is of the correct length, you will feel the engine start to pull hard when your airplane is pulling up in a loop, and it will run a little unevenly as it picks up speed coming down. Again, flying straight and level, the engine should run smoothly.

The complete system then consists of a header, a connecting pipe and a muffler, joined by silicone tubing (see Figure 9). Make the connecting pipe longer than necessary, and use a hacksaw to cut off ¼ inch for each flight, until the engine runs as described. The tuning is fairly broad. There must be no gaps between the sections of the pipe, or the sound will escape through them and through any leaks you have in the system. Even the silicone tubing going to the pressure tap is suspect. The pressure tap can be installed in the muffler or the header. If this connector (mini-pipe), which is tuned to ¼ wavelength, is too long for your installation, use a mini-pipe that's half as long, tuned to ⅛ wavelength; it will also work.

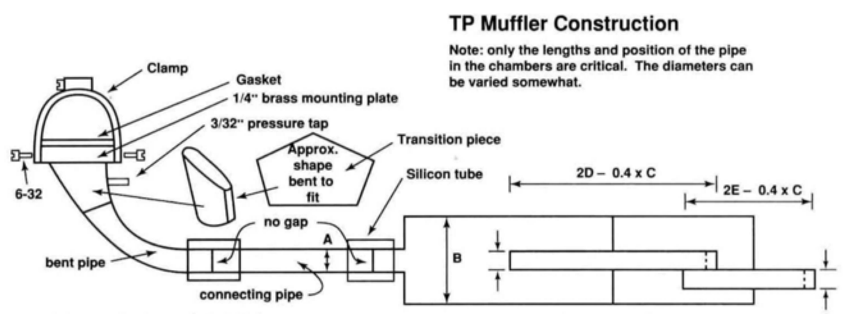
You can also put the pipe inside the first chamber, but you must make a place for it by increasing the chamber's diameter. The cross-sectional area of this header and pipe should be about the same as the area of the exhaust port in the cylinder, or slightly larger than it. Avoid having sharp bends in the pipe and flat sides on the muffler.

Some sound will escape through the system's walls, and the only solution to this is more weight, so soft steel is better than brass. You can also wrap the muffler with full-size-muffler repair tape, but it isn't really necessary, because this muffler reduces sound so much that the propeller and other sources are more significant and have to be dealt with first.

In Part 2, I'll discuss how to make a "TP" muffler; the rules to follow to make it work; controlling prop and carburetor sound; and various other noise-damping devices. ■

**TP Muffler Construction**

**Note: only the lengths and position of the pipe in the chambers are critical. The diameters can be varied somewhat.**




**Tube and sheet of .02" brass**

**Muffler internal dimensions (in.)**

| engine size | A | B | C | D | E |
|---|---|---|---|---|---|
| .20 | .43 | 1.0 | 0.25 | 1.57 | 1.05 |
| .40 | .50 | 1.22 | 0.31 | 1.97 | 1.31 |
| .60 | .60 | 1.40 | 0.35 | 2.36 | 1.57 |

The length of the connecting pipe is varied to tune the exhaust system to engine rpm; approximate length from engine to muffler at 12,000rpm is 10 inches. To increase rpm, shorten pipe (-1 inch = +1,000rpm); to decrease rpm, lengthen pipe (+1 inch = -1,000rpm)—see article.

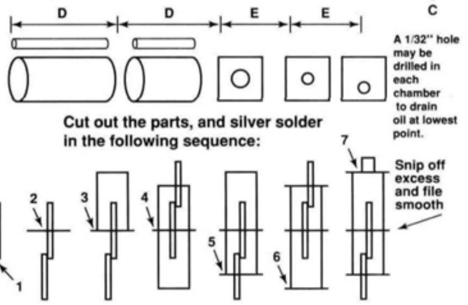



***Figure 8.***

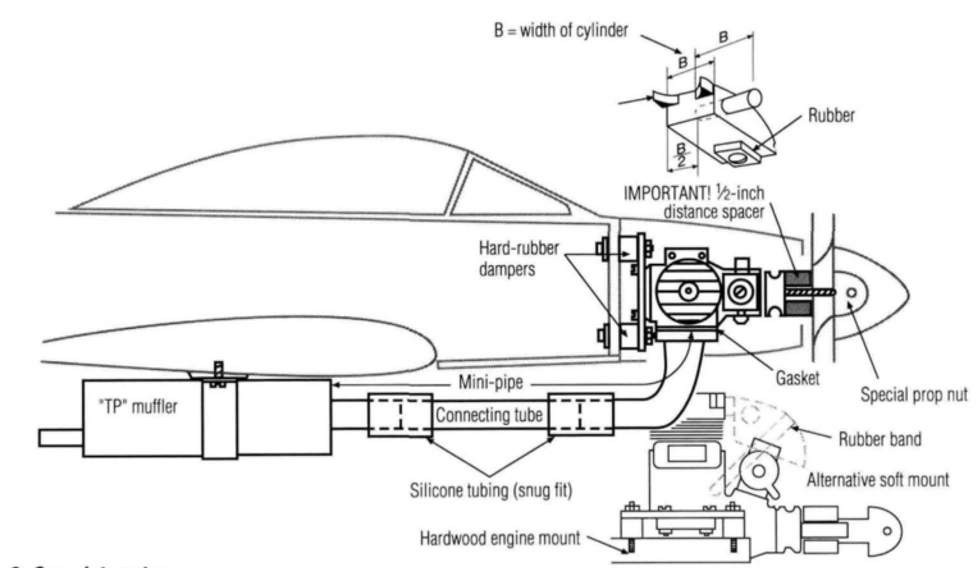



***Figure 9. Complete setup.***

FIELD & BENCH REVIEW

*A high-performance composite sailplane*

## SLEGERS INTERNATIONAL

# PRISM

by SHERMAN KNIGHT

I'M A BIG FAN of T-tails and slip-off nose cones, so when I first saw photographs of the new Prism, I was hooked. The Prism is a descendant of the Spectrum, which I saw at the World Soaring Jamboree. I've since flown several that fellow club members own and, although it's one of the most attractive planes I've ever seen, I prefer the new Prism with its longer wingspan. The Spectrum and the Prism were designed by Ron Vann, and they're both kitted by Slegers Intl*.

### KIT CONTENTS

The kit arrived carefully packaged in a large cardboard box and included many pre-cut plywood and balsa parts and an epoxy-fiberglass fuselage. The white foam wings are pre-sheeted with Obechi and require very little sanding. The necessary basswood was provided. Small parts were protected in a small plastic bag.

The hardware in the kit included: pre-shaped aluminum control horns and a heat-treated tow-hook from Ziagalmayar; Sullivan cables for the elevator and rudder controls; a titanium wing rod from Kennedy Composites; and miscellaneous control rods and plywood pieces. CA, epoxy, white glue, hinge tape, clevises, E-Z connectors, paint and covering material are all that's needed to complete the kit.

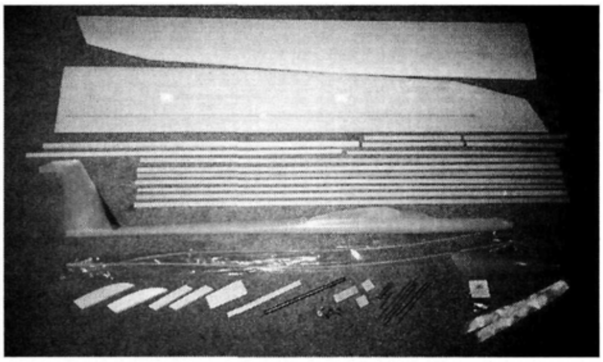
Because the wings and stabs are pre-sheeted, there are no roll-out plans for the kit. Unfortunately, the Spectrum instructions were provided. Although several modifications were made to the instructions, they caused more problems than they solved. Future versions of the kit will include new instructions specifically for the Prism.

### THE WING

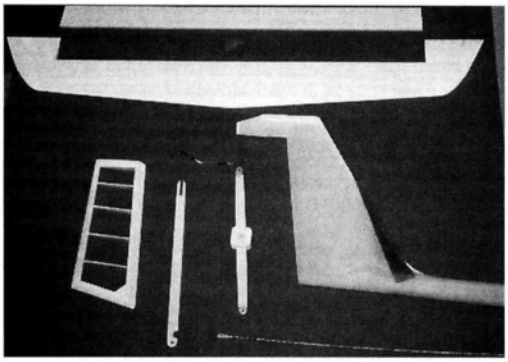
This was the first time I had built a pre-sheeted kit, and I was concerned about the quality of the work. My concerns were short-lived; the pre-sheeted wings and stab were first-rate.

The wings are manufactured by Ron Vann. The spar in the wings is made of high-density balsa with fiberglass sheer webs. The spar is inserted into the foam and then capped with carbon-fiber tow on the top and the bottom. The carbon fiber extends to within approximately 10 inches of each wingtip.

## TAIL SURFACES



*The contents of the box are laid out for inspection. The horizontal stab is the only item not included in the photo.*

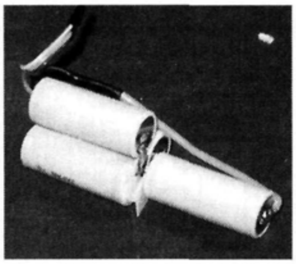


PHOTOS BY SHERMAN KNIGHT

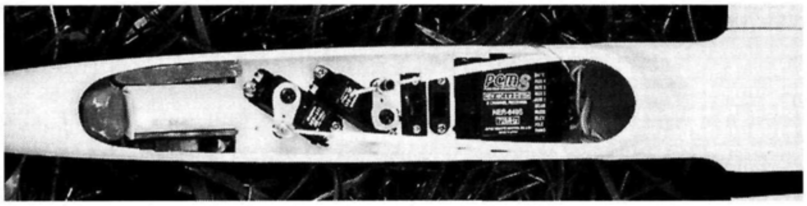
*Completed fin and tail assembly and control mechanisms prior to installation.*

This aircraft does not use a full flying stabilizer. The stabilizer is firmly fixed to the top of the fin with an elevator that provides plenty of pitch control. On the stabilizer, I replaced the basswood capping and the leading edge with high-density balsa. Because the stabilizer is at the top of the T-tail, it's unlikely that you'll damage the leading edge on landing. Also, if there's additional weight in the tail, you might have to add approximately three times as much weight to the nose to balance the aircraft. To identify the location of the mounting holes, indentations in the top of the stabilizer are pre-drilled.

The rudder is built up with medium-weight balsa provided in the kit. Control horns for the elevator are hidden within the fin and don't interfere with the airflow. The control horn for the rudder is mounted entirely inside the fuselage—a very clean, aerodynamic design.



*This is how I configured the battery pack to fit in the nose of the plane.*



*The radio installation that I fit in the plane. Note the angled servos; they help to prevent the servo arm and the E-Z connectors from rubbing against the slip-off nose cone.*

## FUSELAGE

The one-piece molded epoxy/glass fuselage is built by Steve Hug at the Fuseworks. It has a reinforced Kevlar tail boom and slip-off nose cone. Some of the earlier Spectrum kits became fatigued where the fin meets the fuselage boom. To alleviate the problem in the Prism, carbon fiber is used to reinforce this area.

## FINISHING

I finished the top of the wing, both sides of the stabilizer and the rudder with Ultracote*; this stuff is dynamite. It sticks to anything, and it doesn't bubble. The iron's temperature can be significantly reduced when you use Ultracote. Because of the low density of the balsa's open wing, the heat dissipates rapidly through it. With the Obechi hardwood, however, the heat won't penetrate the finish. The heat builds up at the surface very quickly. Don't use a high iron setting. Start at 190 to 200 degrees; if it's any hotter, the Ultracote will bubble away from the wing skins. I used MonoKote* on the wing bottoms; it's difficult to get it to stick to hardwoods, so be patient.

Ron Vann recommends that you use Balsarite* thin formula on the Obechi before finishing with the Ultracote. I also recommend that you do this, at least in the wing-root area. If you use tape in the wing-root/fuselage-joint area, the tape can pull the covering away from the wing skins. The Balsarite's extra adhesion will prevent this from happening.

Although I've long been a fan of the finger-paint method for filling pinholes, I decided to try something different. Jim Thomas introduced me to the Model Magic* method. He rubs a little Model Magic onto the fuselage until the finish has a "greasy" feel, and then he simply wipes it off. Rub it until it feels smooth. Then, to find any pinholes that you missed, apply a light primer coat. As soon as the primer has dried, attack those pinholes with more

## SPECIFICATIONS

**Model name:** Prism

**Type:** R/C sailplane

**Manufacturer:** Slegers Intl.

**Wingspan:** 117 in. (advertised), 120 in. (actual)

**Wing area:** 910 sq. in.

**Weight:** 60 to 65 oz. (advertised), 60.1 to 62.4 oz. (actual)

**Wing loading:** 9.8 to 10.5 oz./sq. ft. (advertised), 9.5 oz./sq. ft. (actual)

**Airfoil type:** SD-7037 (also available in the RG15)

**Aspect ratio:** 15:1

**No. of channels req'd:** 4 (elevator, rudder, aileron, flaps)

**Radio used:** JR X-388

**Wing construction:** white foam-core; balsa and carbon-fiber spar; pre-sheeted with Obechi hardwood.

**List price:** $359

**Features:** the kit includes a well-made epoxy/glass fuselage with Kevlar and carbon-fiber reinforcement and a slip-on nose cone. The wings and stabilizer are pre-sheeted. The wing is a two-piece, plug-in design with a triple-taper leading edge. The pre-sheeted wings and stab are true with straight trailing edges. A heat-treated tow-hook and pre-formed aluminum control horns are also used.

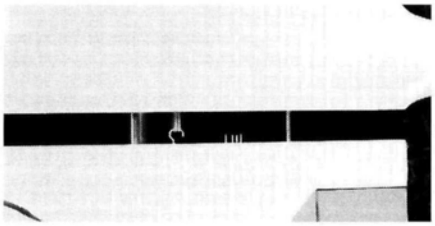
**Hits**
- Delivers competition-level flight performance.
- Aerodynamically efficient T-tail.
- The advertised flying weight is realistic.
- Fuselage is reinforced to withstand competition landings.
- Slip-on nose cone.
- Titanium wing rod.

**Misses**
- Some of the clevises and hinge tape weren't included.

Model Magic. It shouldn't take more than one or two tries to fill all the pinholes on the fuselage. This method is fast, and it requires very little, if any, sanding.

I've been using an enamel, epoxy spray paint on my fuselages. Although this paint takes a fair amount of time to completely cure, once it has cured, it's nearly indestructible.

Because part of the wing surface is a fluorescent pink, I painted the nose cone the same color. Hobby Lobby* sells some of the finest spray paint I've ever seen. It matches many of the Ultracote colors, too. It's expensive, but it's worth it.



*The four-pin Deans Connector coming out of the left-wing root—an easy plug-in wing setup. To ensure that a good connection has been made, check your ailerons before flying.*

## SETUP

I balanced the aircraft with 3.4 ounces of nose ballast. According to the instructions, the CG is 4¾ to 4⅞ inches forward of the trailing edge. I moved that back slightly, however, and I've found that my aircraft flies best with its CG 4¾ inches from the trailing edge.

I placed the tow-hook 4⅞ inches from the trailing edge. With ⅜ inch of flap and ⅛ inch of aileron during launch, the climb-out angle is nearly vertical. Although I usually experiment with tow-hook location, I don't think it will be necessary with this airplane.

I've never owned a model with plug-in wings. All my previous models have had either three-piece wings or top-mounted wings. To reduce setup time on this model, I mounted four-pin Deans connectors permanently on the wing root and the fuselage. After all the servo wires had been soldered onto the back of the male Deans connector, I CA'd the connector permanently into place in the wing root. Then I reinstalled the servo leads to the female Deans connector and routed them inside the fuselage. I pressed a piece of wax paper over the male Deans connector. I installed the female end of the connector, coated the outside of the connector with a putty of epoxy and microballoons and pressed the connector into place; then I let it dry. The wax paper should keep the epoxy from bonding the two plugs. Now I simply plug in the wing, and all the electrical connections are complete. The total ready-to-fly weight was 60.1 ounces, which makes a low-wing loading of 9.5 ounces per square foot.

I like the Prism a lot. Not only is it attractive, but it also flies great. The large ailerons provide crisp roll response, and the flaps provide more than enough stopping power. This airplane is a winner and a real bargain.

**Addresses are listed alphabetically in the Index of Manufacturers on page 134.* ■

## FLIGHT PERFORMANCE

### • Takeoff and landing

Initial trim flights were very good. My friend Jeff Kasner tossed the Prism for the trim flight, and it flew halfway across the field and needed only one click of down-trim. Initial flights were off a winch. With the amount of flap indicated in the control-throws section, the launch was extremely steep and somewhat difficult to control. The aileron-to-rudder mix I initially had was quite small. I increased the rudder mix in launch flap mode on my JR X-388, and the airplane was more controllable during launch.

The model is capable of a healthy zoom launch. At first, I thought the wings were flexing during launch. I had several club members watch through binoculars, and they all assured me that the wings were not flexing. The titanium wing rod deflects a fair amount of flex during launch.

Landing with 90 degrees of flaps required a significant amount of down-elevator trim programmed in to compensate for the nose pitching upward when the flaps were deployed. The flaps hang nearly 1 inch below the bottom of the fuselage. Their stopping power is amazing.

### • High-speed performance

At high speeds, the aircraft tracks very well in a straight line. In a thermal turn, the Prism is very stable. Bank angles remain constant with only up-elevator input. Very little, if any, opposite aileron is necessary to prevent the initial bank angle from increasing. This airplane is very easy to fly.

### • Low-speed performance

The low weight helps it to slow down. At low speeds, however, it easily wanders from the straight line. It can be easily flown at slow, floating-type speeds, and the lightly loaded SD-7037 airfoil has a very gentle stall.

The new airfoils (the SD-7037 in particular) fly at near minimum sink speeds at a high angle of attack. Many models now tend to drag their tails all over the sky. The Prism is an exception to this rule. Because there's significant incidence in the wing, the tail doesn't droop below the wing at low speeds.

Ron Vann recommends mixing trailing-edge camber (down 3/32 inch along the entire trailing edge) with up-elevator. Most of the computer radios allow this function. I highly recommend it.

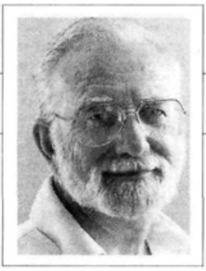
### • Aerobatics

The control surfaces on the wing are huge. The ailerons provide a crisp roll rate with little down-elevator required for inverted flight. The loops are large in diameter, and the rolls are very close to axial. Stall turns, split-S's and Immelmanns can be done, but to obtain the speed needed for these maneuvers, you must dive.

### RECOMMENDED CONTROL THROWS

| | Slegers | Vann | Knight |
|---|---|---|---|
| Rudder | N/A | N/A | 1.25 in. |
| Elevator | 7/16 in. up, 9/16 in. down | Same | Same |
| Aileron | ⅝ in. up, ¼ in. down | ¾ in. up, ½ in. down | 1 in. up, ½ in. down |
| Aileron on launch | ¼ in. down | N/A | ⅛ in. down |
| Aileron on crow | ¼ in. up | N/A | ¼ in. up |
| Rudder-to-aileron mix | N/A | ¼ in. to 7/16 in. | ⅜ in. |
| Reflex and camber | N/A | 3/16 in. up, ⅛ in. down | N/A |
| Elevator pitch compensation (90° flaps) | 20 to 25 percent | 1/16 in. down | N/A |
| Launch flaps | ½ in. down | N/A | ⅜ in. down |

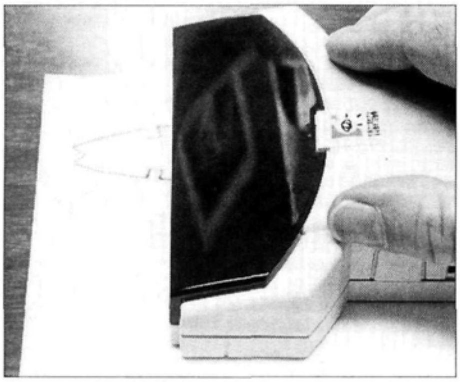
# HOW TO:



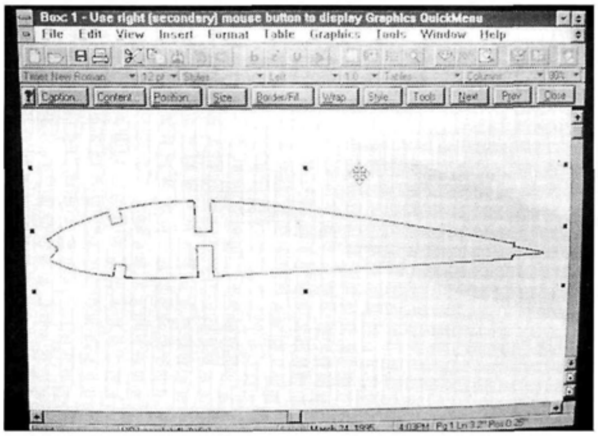
RANDY RANDOLPH

## ENLARGE RIB SECTIONS

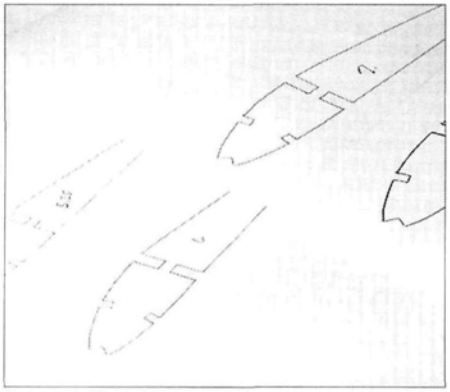
*There has been a lot of excitement about CAD (computer-aided design) and its use with model airplanes—and rightly so. But any computer with word-processing and graphics capabilities and a scanner can easily do one of the things that CAD programs do so well—design scale rib sections for scratch-built projects. It's a simple process, and the photos show the way. Word Perfect 6.1 was used for this demonstration.*



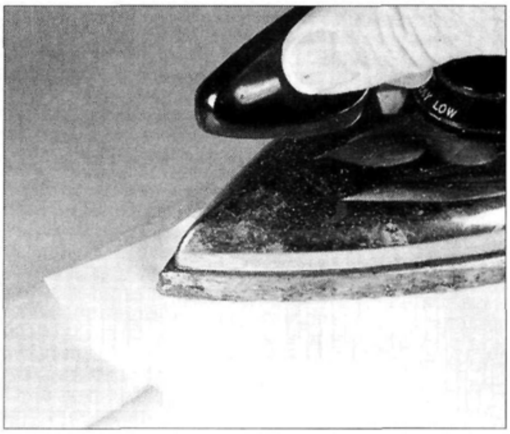
**1** ***First, decide on a rib section that you like (or one that applies), and use your word-processing program to scan it into a graphics box. Rib sections on 3-views work just fine.***



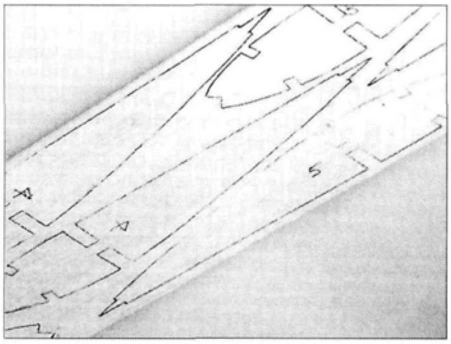

**2** ***When the graphics box has been imported into a document, use the edit box command to make the section larger or smaller; the error margin will be 0.01 inch or less. For a tapered wing, copy the box as many times as necessary and, every time, edit it to the appropriate wing chord.***



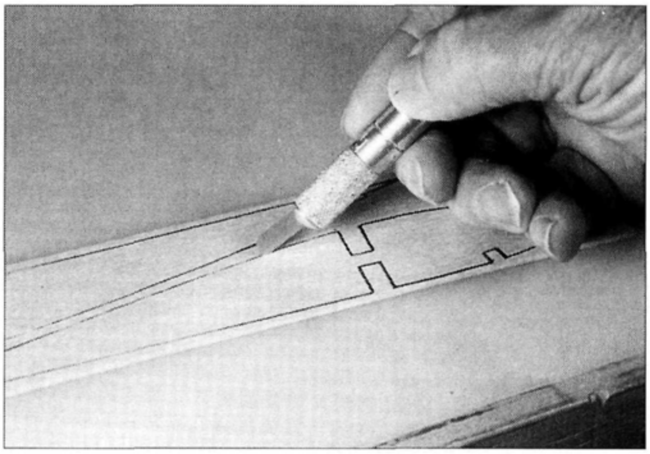
**3** ***Print out the section, and measure the chord. Compensate for any difference in chord size when you edit the box. Mark the size on each rib. Chords that are up to 13 inches long can be easily scaled with a Landscape format on legal-size paper.***



**4** ***If you photocopy the ribs or use a laser printer, the images can be ironed directly onto sheet balsa. Set the iron to the heat that you would use for plastic films.***



**5** ***Each printed or copied rib will generally provide two or three good images when ironed onto sheet balsa. If the sections are positioned properly before printing, several rib outlines can be ironed onto a sheet of balsa at one time.***



PHOTOS BY RANDY RANDOLPH

**6** ***For a tapered wing, cut the ribs out of the printed sheet individually. Constant-chord ribs can be cut out this way, or they can be stacked and band sawed at the same time.*** ■

FIELD & BENCH REVIEW

*The next step for the intermediate pilot*


**GLOBAL HOBBY DISTRIBUTORS**

# American Flyer .40

by ROGER POST JR.

HAVE YOU FINALLY perfected the art of flying your flat-bottom wing trainer, and are you looking for your next airplane? You'll need something that performs well, can maintain inverted flight, is easy to build and flies and looks great. Global's* new American Flyer ARF is a great sport airplane that will fill the need for that second plane in your fleet.

The American Flyer is an all-balsa and lite-ply, .40-size ARF that's well-built and reasonably priced. It's also a great plane for introducing young people to our hobby. When I took this plane home, my two stepsons nearly jumped through the roof. They couldn't wait to open the box and get to work. So, let's start.


## THE KIT

When I opened the well-packed kit, I checked the wings, fuselage and tail surfaces for warps. Everything was as straight as an arrow. There wasn't a wrinkle or a bubble in the colorful finish. The quality of the wood, the construction of the airframe, the hardware and the instructions were excellent.

## CONSTRUCTION

Before you start a project, take the time to read the entire construction manual. Make notes or highlight portions of the manual that are important. In the long run, this saves you time and aggravation, and fewer things will go wrong.

**This is one of the most beautifully constructed ARFs I've ever seen. You can't go wrong by adding this kit to your model collection, and you'll enjoy many hours of satisfying flight.**

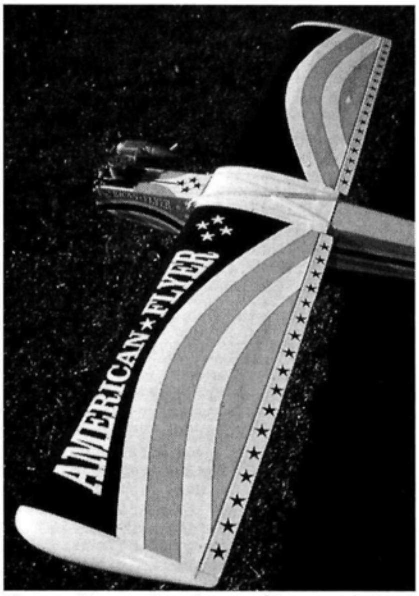
Global has done a fine job of writing the instruction manual, so rather than repeating what they have said, I will discuss some building tips that will enhance the structural soundness of any ARF.

• **Wing.** There's a square hole in the trailing edge of each wing half. Insert the balsa (the matchstick-size piece) into the same side as the wing spar, so that when you glue the halves together, the trailing edge will have an alignment tab. On the top and bottom of each of the three dihedral braces, mark the center with a pen. When you glue the pieces together, you'll have an alignment reference point. After the dihedral braces have been assembled, mark the center line on the face of the brace, and level the top and bottom with sandpaper. Be careful not to distort the shallow vee angle.

*The American Flyer on a crosswind takeoff from the local R/C field. Check out the size of that windsock!*

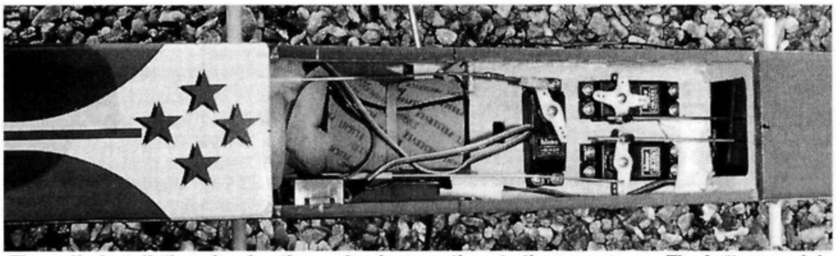
When you glue the wing halves together, look down the length of the wing, and view it from the front to make sure that the panels are aligned and that both airfoils have the same angle of attack. This alignment is extremely important for a straight-flying model. After you've glued your hinges and ailerons in place, push small, flat-head straight pins through the trailing edge and the holes in the hinges. Cut the protruding pins flush with the bottom of the wing, and place a small drop of CA on the pinheads to ensure that the hinges won't pull out. I used one of the elevator hinges as an alignment reference point when I placed the pins. As a safety measure, I also inserted two pins on each side of the hinge.

Before you glue the aileron servo tray to the wing, check the fit of the servo in the tray opening. You might have to enlarge the opening. After I had glued my tray in place, I wrapped a 2-inch-wide piece of fiberglass around the entire wing joint and epoxied it into place. After the epoxy had cured, I covered it with some white, stick-on MonoKote* trim to make it look neater. I like to put an airplane through the wringer, and I figured this would be added insurance. I left off the canopy because I wanted to reduce drag.





*The graphics on the wing provide a great visual reference for the pilot.*



*The radio installation showing the pushrod connections to the servo arms. The battery pack is barely noticeable under the pushrods that extend into the rear of the fuselage. I had to place the pack there to make the plane balance properly.*

• **Fuselage.** The first thing I did to the fuselage was to add epoxy to the inside of the firewall, which helps to keep it in place during those hard landings. Then I tightened the engine mount and nose-gear bracket bolts. (Never assume that these are tight on an ARF model.) Before I glued the tail surfaces to the fuselage, I installed the pushrod guide tubes for the nose gear and throttle, the fuel tank, the landing gear and wheels, the engine, the throttle pushrod and the muffler. I reversed the instruction manual order so I wouldn't damage the tail feathers

## SPECIFICATIONS

**Name:** Global American Flyer

**Manufacturer:** Global Hobby Distributors

**Type:** sport plane

**Wingspan:** 56 in.

**Length:** 47 in.

**Wing area:** 575 sq. in.

**Airfoil:** semisymmetrical

**Weight:** 4 lb., 14 oz.

**Wing loading:** 19.5 oz. per sq. ft.

**Radio req'd:** 4-channel

**Radio used:** Hitec/RCD* Flash 5 FM

**Engine req'd:** .40 to .46 2-stroke

**Engine used:** Magnum .46XL

**Propeller used:** Master Airscrew Scimitar Profile 11x6

**List price:** $150

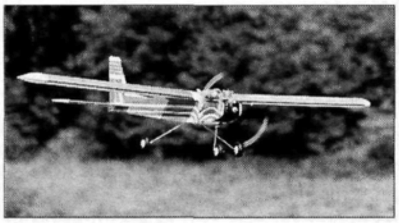
**Features:** strong balsa and lite-ply construction; patriotic film covering; complete hardware package; detailed instruction manual; tricycle gear for good ground handling; a large tail for stability; universal .40 to .53-size engine mount.

**Hits**
- Strong, warp-free, solid construction.
- Colorful, patriotic covering scheme that's bubble and wrinkle-free.
- 4 to 6 hours building time.
- Great flier; very stable and aerobatic.
- Great second airplane for the novice.

**Misses**
- Nose gear was about 1 inch too short, but it was easy to fix (see text under Pushrod Installation).

## FLIGHT PERFORMANCE

*Before the test flight, I ran a few tanks of gas through the Magnum* .46 XL. The propeller was an 11x6 Scimitar Profile by Master Airscrew*. Because the temperature and humidity were very high, I had to turn the needle in more than usual. On the day of the actual test flight, the temperature and humidity were lower, and I had to back the needle out a few clicks. Also, the low-end needle factory setting was a little too lean, so I backed that out as well.*



*Whenever you test a new aircraft, it's absolutely essential to get the best possible performance out of your engine. My friend Bill Fredricks suggested that I try a 12x6 propeller on the Magnum. This lowered the rpm somewhat and allowed the engine to run cooler. I was able to improve the fine-tuning of the engine, and the transition from low to high throttle was much smoother.*

### • Takeoff and landing

The takeoff was as I had anticipated; a little right rudder while feeding in the throttle made for a smooth takeoff and climb-out. There was a left crosswind on takeoff, so I added some left aileron at the start of the takeoff roll and gradually decreased it as the plane picked up speed. The Magnum .46XL provided plenty of power for the climb-out and, to reduce the climb angle, I fed in some down-trim. If you use a .40, I'm sure the climb-out angle won't be as steep. When the plane was in level flight, I added some left aileron trim (to keep the wings level) and a little more down-trim.

The landing was as easy as the takeoff. To maintain a slight descent angle reduce the throttle, and add the necessary up-trim. Fly the plane in the pattern, gradually reduce the throttle to idle, and trim as necessary. A small amount of elevator input before touchdown allows you to groove the plane in for a nice landing. I had set up the rudder with a little more throw than suggested, which was a great help when landing in the crosswind.

### • High-speed performance

With full power, the plane loves to climb. I used about 70-percent power for cruise flight and had to add in some down-elevator trim to keep from climbing. In this configuration, this plane really moves. It had no problem cutting into the wind or performing aerobatics. I attempted a power-on stall (full power), but the plane just kept climbing. The throttle had to be reduced in order to achieve a power-on stall. A nice, gentle stall was all that happened. Recovery was easy; I let go of the elevator stick and added a small amount of power. With a .46, this plane will go quite fast. If, however, you've just finished with a slow-moving trainer, I'd suggest using a .40 to keep from scaring yourself.

### • Low-speed performance

Low speed is very easy to achieve; just pull back the throttle, and add the necessary up-trim. I got the plane to hover in strong wind conditions and almost got it to go backward. (I needed just a little stronger headwind to do that.) The increased rudder throw was very effective at slow speeds and during windy conditions.

A low-speed stall wasn't easy to attain. With an idle power setting and full up-elevator, the plane just mushed along. Eventually, it stalled, with a very gentle break.

### • Aerobatics

I had a lot of fun putting this one through the wringer. One thing is certain; you'll always know if the right side is up when the color scheme comes into view. To test the airframe, I started with rolls and loops. Everything held together, and the plane tracked well through the maneuvers. Adding rudder during the roll helps to achieve a faster roll rate. The plane flew well inverted and needed only a moderate amount of down-elevator to maintain altitude. If you increase rudder and aileron throws, you can make the plane do spins, stall turns and snap rolls. Besides these maneuvers, I was able to get the plane to fly knife-edge while holding corrective controls. With some practice, you can do all the gentle-to-moderate aerobatic maneuvers that you can think of.

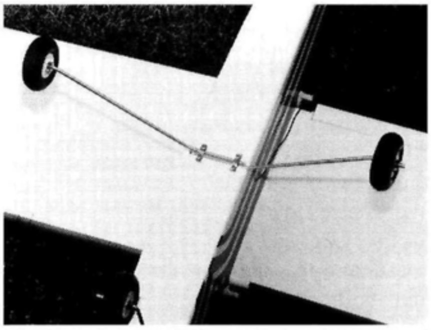
This plane is a great second aircraft and one that will help you achieve better aerobatic performance. The color scheme makes attitude recognition easy, and it also looks great in the air.



when working on the engine and gear installation. I decided to solder a threaded brass coupler onto the throttle pushrod and use a plastic clevis to attach it to the carburetor arm. The Z-bend method works well, but I like to have a little more adjustment available. Global has filed flat spots in the nose-gear struts. This is greatly appreciated by those of us who have been frustrated with the nose-gear strut turning inside the steering arm.

Before installing the servo tray, check the fit of the servos and the tray in the fuselage, and trim to fit where necessary. I didn't glue the dowels in place because if one broke, I would damage the fuselage when I tried to remove it. The tension from the rubber bands is all that's needed to hold the dowels in place. Cut away the small piece in the tail post, then trial-fit and glue the horizontal stabilizer mounting plate in place.

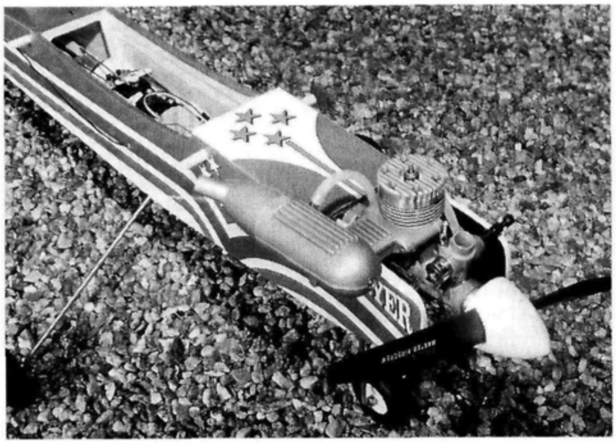
I wanted accurate alignment when I glued on the tail surfaces, so I ran a piece of string the length of the fuselage. Having already made the center-line mark, I lined up the engine crankshaft, the two center-line marks and the rear of the fuselage to see how straight the fuselage was. It was like an arrow. Next, I attached the wing with a couple of rubber bands and made sure that it was aligned properly before trial-fitting the horizontal stab. When I was satisfied with the fit, I installed and aligned the stab according to the instructions and kept an eye on the alignment until the epoxy had cured. I used shims to make the stab level. If you use shims, sand small, thin pieces of balsa into wedges, and place them where they're needed to achieve a level stab. Any excess can be trimmed off after the epoxy sets.



***The installation of the main landing gear. I drilled small holes in the landing-gear blocks for the screws.***

The vertical fin was next, and I used string and a square to help with its alignment on the fuselage. (All this trial-fitting and alignment is well worth the effort; it results in a perfectly straight airplane.) I

installed the dorsal fin before I put the covering on. This made it easier to align the dorsal fin and the color stripes on the covering piece. To help the alignment, I drew a center-line mark on the fuselage at the front part of the dorsal fin. After the fin and stab had been set, I installed the tail-control surfaces and pinned the hinges.



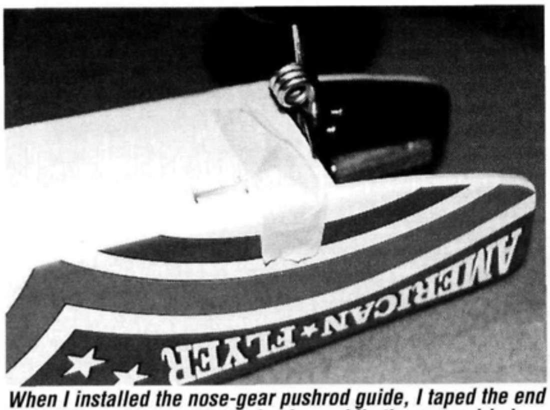
***The completed engine installation shows the plastic clevis connected to the throttle/carburetor arm.***

• **Pushrod installation.** The elevator and rudder pushrods are easy to make. Just remember that on the elevator pushrod, the rod that's attached to the servo is on top of the rod, and the two pieces that are attached to the elevator-control horns are on the sides of the pushrod opposite each other. For added protection, I put masking tape over the shrink-wrap. Make sure that the wires are tightly bound to the dowels. When you install the pushrods, it helps to run guide tubes down the length of the fuselage from the pushrod openings to the radio compartment. Insert the pushrod ends into the tubes, and slowly pull the tubes back toward the tail. This makes installation less frustrating. Attach the rods to the control horns; make sure that they move freely and that they don't bind in the exit holes. If you find that the nose-gear strut is a little too short, use the nose-gear bracket, and secure the strut with a wheel collar directly above and below the bracket.

• **Radio installation.** Install the radio according to the instructions. Hook up the control surfaces, and verify that everything moves in the proper direction. If you're a novice, follow Global's suggested throws. If you want some differential in your ailerons, bend the control arms in equal amounts toward the trailing edge, and attach the pushrods to the 10-o'clock and 2-o'clock positions on your servo wheel (as viewed from the top with the trailing edge close to you). Make sure that the aileron torque rods don't hit the rear former of the radio compartment when the ailerons go up. You might have to experiment with different servo-wheel or arm placements if you want differential.

• **Balance.** Using a pen, mark the CG on the sides of the fuselage. Put the wing on, and hold it down with no. 64 rubber bands. (Use six per side, and cross them for a stronger hold.) Now, place your fingers under the wing at the CG mark, pick up the plane and check the balance. If the plane is tail-heavy, move the engine forward; if it's nose-heavy, move the engine back. If it's still unbalanced, shift the battery pack to achieve the desired result. With an empty tank, the plane should balance perfectly level.

After you've run your engine, checked the radio range (also do this while the engine is running; sometimes vibration has a way of interfering with radio signals) and checked all of the linkages and bolts, you're ready to fly.



***When I installed the nose-gear pushrod guide, I taped the end so that the guide would stay in place while the epoxy dried.***

## CONCLUSION

This is one of the most beautifully constructed ARFs I've ever seen. You can't go wrong by adding this kit to your model collection, and you'll enjoy many hours of satisfying flight. As your flying improves, you'll see that this plane can really perform. Good luck, and enjoy a great product. ■

**Addresses are listed alphabetically in the Index of Manufacturers on page 134.*

# GOLDEN AGE OF R/C

HAL deBOLT

## OT NOTES AND NEWS

Last time, I tried to report all your input, but I hardly scratched the surface, so it seems appropriate to continue this time—enjoy!

I received a note from Alex Konopacki of Port Saint Lucie, FL. Alex is a member of the prestigious Sundancers R/C Club and was intrigued by our autogyro. He sent us a photo of the neat rendition that he put together, and he agrees that, as reported in the construction article, gyros do handle differently than planes. He sees the potential for unorthodox flight, but just like helicopters, gyros pose a real challenge to R/C pilots. At this time, only three flights were under his belt—hardly a start on the learning curve. I hope that, by now, he is enjoying his autogyro as much as others have reported that they do!

*Alex Konopacki's neatly done autogyro. He finds that flying a gyro is different than flying a plane.*

Thanks to the renewed interest in gyros that you have shown, I'm sorting out an advanced version of the original, which seemed advanced 18 years ago! It still is fun!

Bill Weaver of Middletown, MD, has a stable full of Live Wires (LW) from the '50s, which he still enjoys flying. Bill suggests that what he has done to his LW Kitten could be done to a modern OT'er. Back in '53, Bill's Kitten flew with a Port gas tube receiver, a Bonner escapement and was powered by a Mills .075 diesel. He says it performed well at 18 ounces, and he's surprised to realize that, 40 years ago, he was flying mini-R/C!

Recently, Bill updated his Kitten by replacing the silkspan with micafilm. He also switched to a modern mini-radio and servos and added elevators. Now it weighs only 12 ounces, and he says that the Dart .03 diesel powers it well and allows all the usual maneuvers. He thinks that his plane may be superior to many of the modern mini-R/Cs. Old R/Cs never die; they just get better!

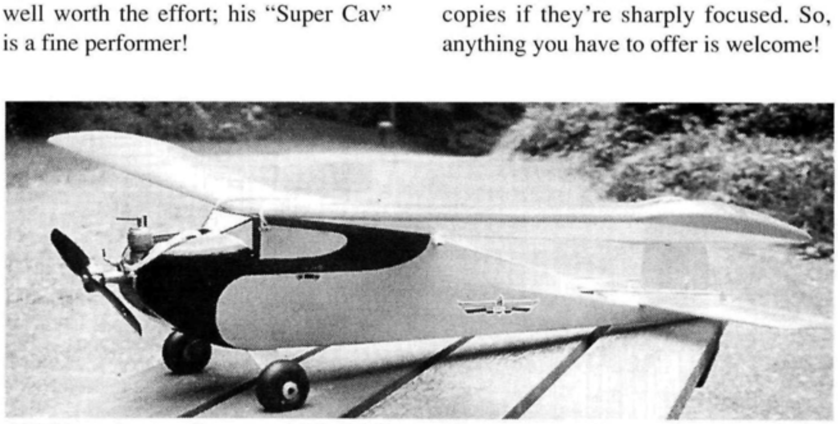
A while back, Jim Shannonhouse of Forest Park, GA, sent us some interesting photos from the '57 Nats. I hate to hold them back any longer, and I think that you'll enjoy them.

Don Saunders of Marysville, WA, thought you'd like to see his recently restored, 20-year-old Cavalier. Note the twin rudders and wing slots that were added to create the "Super" version. Don uses an Airtronics radio and a Laser .61 for power. His model was badly scorched in a fire several years ago, and he now says the rebuild was well worth the effort; his "Super Cav" is a fine performer!

Dave Luchaco of Coopersburg, PA, writes to say that he recalls his Dad flying with the "Flying Sparks" of Elmira, NY, and the Valley R/C Club in Sayre, PA. That's my old stomping grounds, so surely his dad and I shared the sky on more than one occasion. Dave is interested in joining the VR/CS activity with a Brett "Perigee"; he always admired the one that his father had!

Cliff Wierick suggests a source of plans. Here are two possible suppliers of OT R/C drawings: Fran Ptaskiewitcz, 23 Marlee Dr., Tonowanda, NY 14150 and Tom Dixon, P.O. Box 671166, Marietta, GA 30066.

I also had a nice letter from R/C pioneer Frank Madl of Des Plaines, IL, saying that he's still active at 79 years young! He tells us that he just recovered from a cracked shoulder that he suffered while retrieving his Tiporary plane. For those not in the know, the Tiporary is a hot pattern model—even for the younger set! Recuperation allowed him to test his new giant-scale A-26 "Inader" twin! Frank is well-known for his very early use of the Cavalier for R/C. Unfortunately, the photocopies that he sent of Harry Sampey, Alex Schnieder and Howard McEntee posing with it can't be reproduced well. But we can use most photographs and even photocopies if they're sharply focused. So, anything you have to offer is welcome!



*Bill Weaver's recently restored '53 LW Kitten. With modern equipment, it performs better than ever.*

**STATIC ON THE "AERATORWAVES"**

Peter Mohr of Point Arena, CA, tells us about his Aerator experiences as a 15 year old. His experience reflects the best (or worst?) of early R/C and is worth sharing.

Jim Walker's demonstrations at the Plymouth Internationals convinced Peter that R/C was for real. In high school, he learned some basic electronics and, as youngsters will, felt confident that he could master radio, so he ordered one of the first R/C kits.

*Don Saunders with his nicely rebuilt Super Cavalier. He says it is pretty to watch and a fine performer.*

When the Aerator kit arrived, he inspected it closely. He had chosen the Jasco "Floater" glider powered by an OK Cub .09. He thought that the large size and low power would carry the heavy batteries in easy, slow flight and that it would allow time to anticipate and correct mistakes—good thinking?

The receiver was straightforward—a printed-circuit board, tube and capacitor. The transmitter was something else—a tube, a capacitor, a couple of resistors and some thin plywood for a case. And the escapement was positively thought-provoking—three folded, thin, brass pieces, a shaft, what looked like a nail and some wire. He says that a "Heath kit" it was not!

He assembled the transmitter and, in his garage, set up a couple of bamboo poles to work as a dipole antenna for testing. Fortunately, a friend down the street was a ham operator. A phone call brought the ham receiver to life, and he pressed the signal button. His friend's response was immediate, "Turn the blasted thing off! You're splattering all over the band!" At least he knew the

# R/C PLANE EVOLUTION

To set the stage for this design, it must be understood that in 1960, the initial transition to the low-wing configuration began. I had just returned from a month-long session in Europe flying daily demonstrations with Dunham and Kazmirski. As we've indicated, Dunham's Voltswagon was a spectacular performer and conceptually advanced. All who saw it wanted to own one!

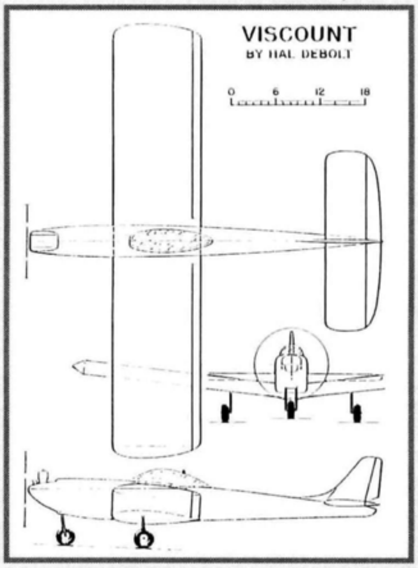
*Hal deBolt at a Philly Nats with the original Viscount. Note the Space Control transmitter.*

At the time, the Live Wire series included the Pursuit—an excellent, fundamental low-wing R/C. But it was the size of an Astro Hog, and it seemed that a smaller plane would be superior. The inclination was to kit the Voltswagon or at least to copy it. But further thought indicated that the market would rather have something simpler than the Volts' rounded fuselage and tapered-wing complexity.

So, the desirable features of the Voltswagon were applied to the simpler Viscount structure. If the Viscount had less dihedral, it would be hard to tell from today's low-wing sport offerings.

The Viscount's performance demonstrated the value of the Volts concept, and it was a joy to maneuver. A couple of notable factors: a steerable nose gear and ailerons were a necessity; Jack Roth produced the first commercial, steerable nose gear for it. The aileron concept would prove itself useful in future models.

We had admired a full-scale Goodyear Racer that was built by a Bell Aircraft engineer. The full-span ailerons on that plane were of great interest. The nasty and complex problem with normal ailerons was the linkages and the further complexity created by the fact that they were part of the wing structure. The Goodyear's ailerons gave us an idea! Why not just hinge strip ailerons onto the wing's trailing edge? Eureka!—the simple wing structure and minimum linkage that's widely used today.




*Three-view of the 60-inch-span LW Viscount. It used a .46 for power.*

The "zero-zero" force arrangement that was commonly used required that the pilot change elevator trim settings as speed

Above: San Francisco's Dale Root with his outstanding Ascender at the '57 Philly Nats. Right: giant scale is new? William Vernie's daughter poses with his OK twin-powered Buhl Bull Pup at the '57 Philly Nats.

transmitter worked! After considerable frustration, the receiver and escapement were finally put together. After some "tuning," the relay actually pulled in and the escapement operated—most of the time at least!

The day of reckoning finally came and, with his 10-foot dipole antenna erected, the Aerotrol-Floater was readied and launched. Radio interference made the plane turn unexpectedly, which was alarming because each time the nose dropped, it looked like a disaster in the making! As the Floater flew on, it was obvious that a turn had to be made or else it would be lost. As expected, holding the turn caused the model to skid into the ground. The wing had been popped off, but damage seemed minimal as Peter rushed to retrieve his plane. The only question was, what is the bright light in the radio compartment? After inspection, it appeared that the 45V "B" battery had shorted the XFG-1 tube filament! Berkeley Models was out of tube stock, and Peter was off to college, so his R/C hopes were temporarily sidelined. So much frustration had to be overcome in those early times!

Fortunately, Peter Mohr is still with R/C these many years later. After his college graduation, success was his with a Lorenz transmitter and a "Wavemaster" in an LW "Champion."

And so it was—a rough path that's so much smoother today! ■

Hal deBolt's daughter, Pat, displays the retract-gear-equipped Viscount. This was the first retractable gear in Pattern at a Chicago Nats.

was changed. This was thought undesirable. The Viscount's solution was to use a lifting horizontal tail, the lift factor of which was proportional to that of the wing. The proportion remained constant over a wide speed range, thus the Viscount flew level over the wide speed range without requiring any elevator trim changes and maintained neutral stability.

The release of Dmeco's Viscount kit was timely, coming when many were looking for a simple way to enter the low-wing craze. Thousands of kits were produced over the years, and they made many R/C'ers happy.

Would you care to tell us about *your* Viscount?

# SR Wins '95 AMA Electric Nats!

Well, we didn't exactly win the Nats. We won half of the Nats, or at least our customers did!

Class A Sailplane (610), Class B Sailplane (612), Class A Old Timer (618), and Class B Old Timer (620) were flown. In each event there were three winners, First, Second, and Third for a total of 12 possible winners. SR Max 1100 Series packs were used to win 6 of the 12 winning positions. And in addition, the SR Smart Charger/Cycler was the charger used to win those 6 winning spots.

Tom Hunt won First Place in Class A Sailplane, Second Place in Class B Sailplane, and Second Place in Class B Old Timer using SR 1100 Max Series packs and the SR Smart Charger/Cycler. Don Belfort won Second in Class A Old Timer and Bob Aberle won Third in both Class A and B Old Timer using the same combination.

A new cell, the SR Max 1200 LMR Series was introduced at the Nats and should be a sure winner next year. It has more capacity and a lower internal impedance but only weighs 1/10th ounce more than the 1100 Max Series cell that was so successful this year. It is designed specifically for Limited Motor Run (LMR) events and very high current drains. SR salutes everyone who participated and invites all of you to next year's AMA Electric Nats to be held in Muncie, the last weekend in July '96.

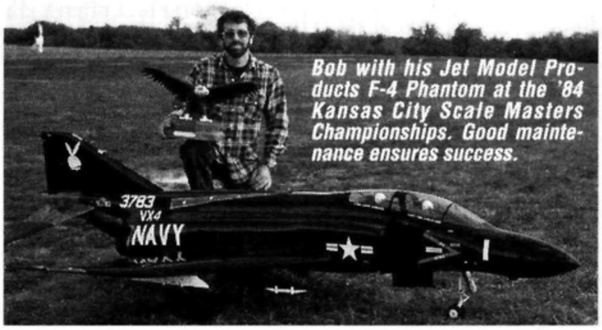
If you'd like more information about the Electric Nats or any of our packs, chargers, motors, or other Electric Flight supplies, call 516-286-0079 or write us at SR Batteries, Box 287, Bellport, New York 11713.

# JET BLAST

BOB FIORENZE

## 10 POST-FLIGHT MAINTENANCE TIPS FOR DUCTED FANS

WHAT DO YOU do with your ducted-fan model after a typical day of flying at the club field? Do you just put your jet away? Of course not. You should inspect it and prepare it for storage so that it's ready to go the next time you head for the field. Here are some of the things that I check before I put my plane away.



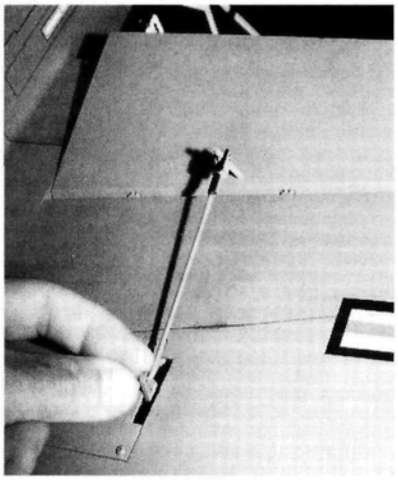

*Bob with his Jet Model Products F-4 Phantom at the '84 Kansas City Scale Masters Championships. Good maintenance ensures success.*

• **Oil.** With most tuned-piped systems, oil stays in the muffler. If you store your airplane nose down (assuming you have a tractor-configuration ducted-fan), oil tends to seep into the engine's front bearing, possibly into the fan rotor area and into the fan intake. Residual oil from all sides of the exhaust tailpipe can leak into the frontal area. I usually hang up my plane, tail down, as if it were on a meat hook. I let it hang there for an hour or two to get the residual oil out so that it doesn't make a mess later.

Next, I turn the plane upside-down. If it's a rainy or humid day, the oil on the axles will probably wash away. Spin the tires to make sure the axles aren't dry. You might have to pull the wheel collars off and re-oil your axles.

• **Linkages and hinges.** When your jet is upside-down, the horns and clevises are usually exposed and easily accessible. Now you can test your pushrods, i.e., the rods that are connected to the ailerons, flaps, elevator, rudder and motor control. Make sure that the screws that hold the horns in are secure as well as the hinges. Pull on your servo to make sure that it's tight. Even though you don't inspect the actual servo tray, you can just pull and tug on everything. Sometimes, the landing-gear bolts can vibrate loose, so I check them, too.

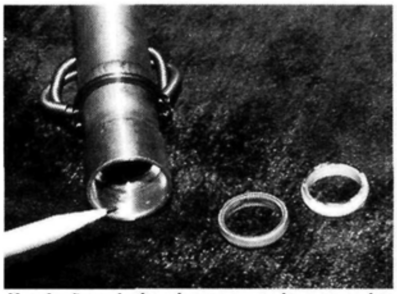
*Engine/fan vibrations can loosen hardware. These 4-40 landing-gear bolts, which are close to the engine, are checked for tightness. Don't forget to check those axles for lubrication.*



*To check the integrity of the servo tray and clevises, pull and tug on the servo horns, hinges, linkages and control horns. You're looking for excessive play and potential for failure.*

Next I flip the model right side up to inspect the inside. I check all the bulkheads, the wiring and the air lines for wear. There's a bulkhead here with a wire going to one of the aileron servos. The wire looks as if it's making contact with a section of the plywood bulkhead. Make sure that the wires aren't frayed, because this is an area where there could be problems.

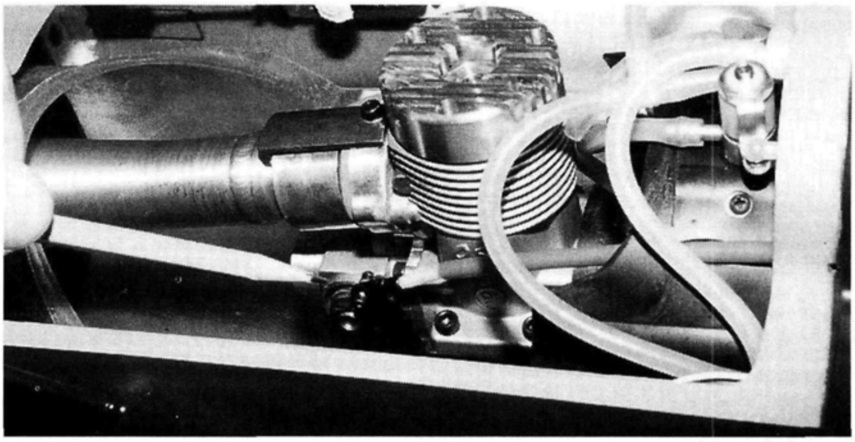
• **Exhaust-system fittings.** The engine is a critical area that requires careful inspection after a few flights. Take, for example, a typical O.S. 91 Dynamax-type setup. If the muffler-pressure fitting on the tuned pipe becomes loose, the pressure will be intermittent. (Fittings are usually attached with JB Weld* or silicone.) Adjusting your engine at the flying field can make you pull your hair out. No single adjustment will work. The O-ring that holds up the tuned pipe can snap, and this puts undue stress on the header, which can then break the header bolts. If this happens, you have to remove the engine and re-tap the bolts (another hassle to avoid).



*Header/tuned-pipe damage can be expensive to fix. Avoid completely blowing away the silicone O-ring, which results in header/pipe metal contact.*

Check the heat-seal O-ring—the one that's between the header and the tuned pipe. It should be replaced every three or four flights. I know they're expensive, but if they fail and you're on a pipe-pressure system, you'll lose pres-

*Using a flashlight, check the color of the piston's top. If it's a caramel color, it indicates that the engine is being broken in properly.*



*The area behind the cylinder head is prone to vibration. Check the tightness and integrity of the throttle linkage, the carburetor bolts and the header bolts.*

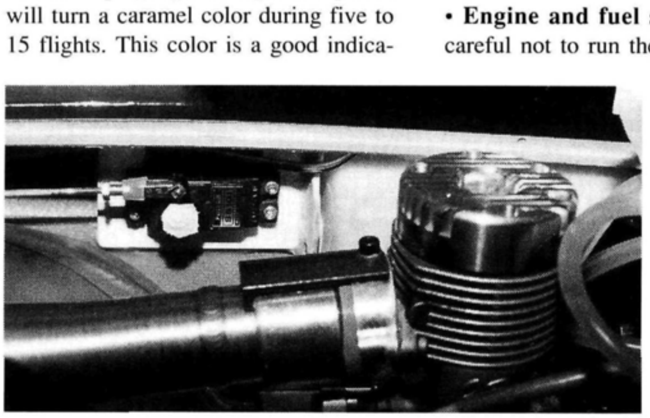
sure and probably fry the engine (go super-lean instantaneously). If you're on the Pitot system, you won't go lean but, in either case, you could still damage the front of the tuned pipe, and it would have to be sent back to the factory for header-pipe repairs.

• **Glow plug.** Pull your glow plug after three or four flights, and check the coil. If it's pushed off to one side, chances are that the plug should be thrown out. Another candidate for the garbage is a glow plug that looks crystallized. This is the most dangerous time to reuse the plug. It glows when you put a Ni-Starter* to it and appears fine when, in fact, it's on the critical list. Flash a light on the top of the piston while the plug is out. When a new engine has been broken in properly, the top of the piston will turn a caramel color during five to 15 flights. This color is a good indication that you're breaking in your engine with plenty of oil, i.e., the engine is running rich, and it stays cool.

• **Rotor blades.** On certain aircraft, the inlet design allows you to reach in and pull on the rotor. Shake the rotor to see if anything feels loose. Excessive play means worn bearings and reduced plug life; bearing replacement is a must. Check the blades; maybe you picked up a stone. If a blade is chipped, it will fail; it will also make the other blades fail, cause vibrations and possibly kick the rotors off the crankshaft. I've seen rotors cut aileron and elevator wires and chew up the inlet. I've also had the carburetor fall off the back of my engine because the carburetor bolts have loosened.

• **Engine and fuel system.** If you're careful not to run the O.S. 91 too lean or too hot and you throttle back during certain maneuvers, loose head bolts won't usually be a problem. Don't forget to check the throttle arm. It can develop cracks that can eventually cause throttle failure. (Runaway throttles are no fun.) If you use a ball link, make sure there isn't too much play in the plastic link, the bolt, or the nut. Also, check your tank for cracks and leaks, and make sure that nothing rubs against it.

• **Battery.** Now is a good time to check your battery capacity. Let's say you're getting 200 minutes on a full charge and cycle, and your jet has made three flights. If you discharge the batteries as soon as you get home, and there are 100 minutes left, then you actually used half of your battery capacity. You probably could have safely made at least two more flights.



*Vibration and direct wire/bulkhead contact make it mandatory to check these contact points for servo-wire wear. Also note masking tape "safety." The servo-horn screw can never "back out" because of vibration. Additional redundant safety precautions include a jam nut, fuel tubing and a metal safety clip on the clevis (Sullivan* no. 256 shown). All this adds up to less concern about your equipment and more concentration on flying.*

This whole inspection procedure should take all of 20 minutes—a small price to pay for a trouble-free day of flying. As with all modeling activities, remember to "make haste slowly."

**Addresses are listed alphabetically in the Index of Manufacturers on page 134.* ■

FIFTEEN YEARS AGO, a small group of modelers with a common interest in large R/C aircraft formed an organization to promote this interest in a non-competitive arena. This group called itself the International Miniature Aircraft Association (IMAA). It has since grown to include 10,000 members worldwide.

## IMAA's 15th annual festival of fun

Every year, IMAA chapters from across the country submit bids to the IMAA Board of Directors that request the honor of hosting the following year's annual Festival of Giants event. When the Board chooses the site, it tries to ensure that the festival moves around the country. In recent years, the festival has been held in Connecticut, Washington, Wisconsin, Missouri and Texas.


Ray Hattman from Wallingford, CT, built this 77-inch Ziroli* PT-17 Stearman and painted it with HobbyPoxy* paint. A Don Harris* smoke system is installed for show work. At 21 pounds, it's a good flier.

# 1995 RALLY OF GIANTS

by FRANK PONTERI

PHOTOS BY WALTER SIDAS & FRANK PONTERI

A ⅓-scale Piper Colt built and flown by Jean Chevalier from Quebec, Canada, sits on the flight line. He owned and flew a full-size Colt and decided to build a slightly smaller model. A Quadra .50 is under the hood of this 116-inch-span, 28-pound bird.

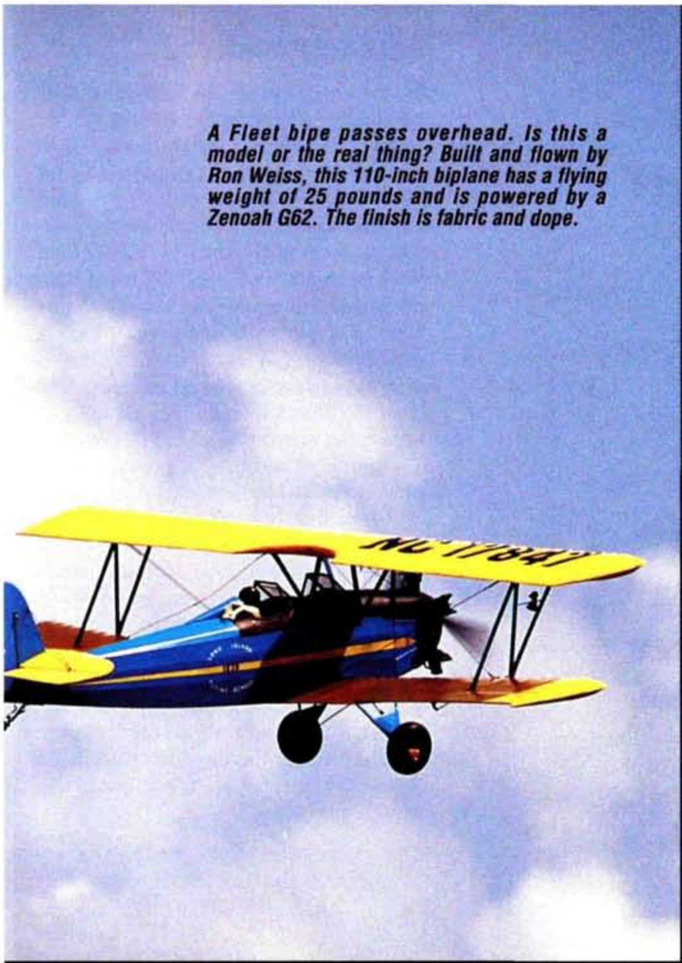
Above: an F8F-2 Bearcat scratch-built from Ziroli plans. Powered by a Sachs* 3.1 engine, this all-wood, 33-pound aircraft was covered with fiberglass and painted with Cheveron* paint. The electric landing gear is made by by Likes Line*.


Don Albright's scratch-built B-17 Flying Fortress on a bombing run. With a wingspan of 13.5 feet and weighing 76 pounds, this aircraft was a real crowd-pleaser. Power is supplied by four Q42s.

### '95 FESTIVAL OF GIANTS

This year's event was held at the Danville Regional Airport in Danville, VA, on June 22 through June 25. It was sponsored by the Danville AeroModelers, the Danville Park and Recreation Department and the Danville Regional Airport. To say that this event had the support of the city would be an understatement. It seemed as if every municipal department (including police and fire) played a part in making this event a huge success.

On Tuesday, June 20, I arrived in Danville after an 800-mile drive from Chicago. After checking into my motel and getting a bite to eat, I decided to take a ride out to the flying site to have a look. Because it was two days before the event, I didn't expect to see anyone at the field, except possibly the



A Fleet bipe passes overhead. Is this a model or the real thing? Built and flown by Ron Weiss, this 110-inch biplane has a flying weight of 25 pounds and is powered by a Zenoah G62. The finish is fabric and dope.

Jim Himmelsbach of Quakertown, PA, flew this smart-looking Nosen P-51 Mustang with a Bald Eagle paint scheme. It has a 100-inch span and a Sachs 100cc engine turning a Zinger 24x14 prop; Likes Line retracts.

Nine-year-old Patric Magno was the youngest pilot at this year's event. Aided by his father Tom, Patric is at the controls of Tom's Byron Beechcraft Staggerwing. The 18-pound aircraft is powered by a Quadra 35 and was painted with Krylon lacquer.

Left to right: Dick Reed, Dennis Gergtis and Warren Thomas with the 35-percent Carden Extra 300S. This aircraft is so docile that even an average pilot can look good flying one. Give one to Frank Noll and Warren Thomas, and you'll have a fantastic team demonstration such as we had on Saturday.

Below: to scratch-build this giant Lazy Bee, Phil Honeycutt blew up the plans from a Clancy* kit to 3.5 times the original size. The airframe is all wood with a 134-inch wing and a 44-inch wing chord. At 38 pounds, the aircraft flies well with a ST3000.

Left: after a flight, Joe Grable's 26-percent Cessna Skymaster taxies back to the pit. The aircraft has a 120-inch wingspan and a flying weight of 40 pounds. Power is supplied by a Saito 300 in the front and an O.S. 1.60 engine with a 18x6 pusher prop in the rear. Joe also had his 26-percent Cessna 150 on hand.

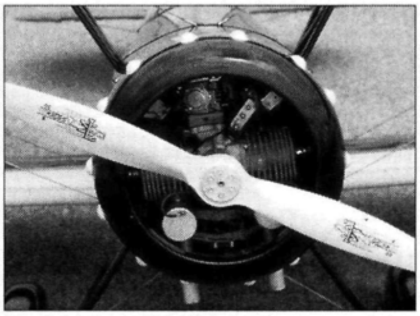
setup crew. Much to my surprise, close to 50 fliers had already arrived and had begun to erect their canopies at the flight line. By Wednesday afternoon, close to 100 pilots were on hand and, in the late afternoon, they were allowed to fly. That evening, many of the aircraft were displayed at a local mall show.

The event officially began on Thursday with a welcoming speech by the mayor of Danville that was followed by pilot registration and aircraft inspections. A group of IMAA fliers from Delaware helped the host club with the aircraft inspections. Registration grew daily and reached its peak on Saturday afternoon with 380 pilots and almost 1,000 aircraft. With the exception of late-night thunderstorms, the weather was quite good


Larry Alles loves 'em big!—really big! His 40-percent Waco YMF-5 weighs 50 pounds and has an 11-foot wingspan. The power comes from a 3W120B2 engine.

# Big is Better

Larry Alles from Flemington, NJ, is one modeler who believes that, if big is better, really big must be *really* better. Last year, Larry built his 40-percent Stearman, which weighs a little more than 50 pounds. Larry put on a number of demonstration flights with this aircraft during this year's Festival.



He also flew his new aircraft—a 40-percent Waco YMF-.5, which he built from Jim Pepino* plans and increased by 50 percent. This 8-foot, 50-pound model has a wingspan of 11 feet and a wing loading of 25 ounces per square foot.

SuperShrink Coverite* and acrylic enamel were used to cover and paint this big bird. A 3W120B2 engine swinging a Zinger* 30x8 prop supplies all the necessary power. Controlled by a Futaba* 7UAP radio, the Waco uses one 1/4-scale servo for each control surface. An electric smoke system has also been installed.


for the entire event. The sellout Festival banquet was held on Saturday night.

I spent Friday and Saturday with Walter Sidas, the staff photographer for *Model Airplane News,* walking the flight line and interviewing pilots as he photographed their aircraft. This issue could have been filled with nothing more than photos of the many fine aircraft at this event. On Saturday afternoon, I took a walk through the pilots' parking area to look at the various license plates. It was clear that IMAA members came from all across the country to attend this event.

One might ask why a person would drive from California to Virginia to attend an event that offers no prizes and has no competitive events. The answer is simple—to have a good time with modelers who share common interests, to show off your aircraft and to exchange knowledge.

In my opinion, the one and only reason the IMAA has grown to its present size is that it's not about competition; it's just about having fun. Attend an IMAA fly-in in your area, and you'll see why "big is better."

# Fast-Charging at the Field

Here's JR's Mike Stokes' setup for charging radios at the flying field. The Hitec Multi Charge-A-Matic runs off a 12V battery.

**Over the past few years, I've read many articles on the pros and cons of fast-charging transmitter and receiver Ni-Cds at the flying site. I have never felt confident about such battery charging and have not put my aircraft at risk by using this method. On Friday, as I was walking past Mike Stokes' trailer, I heard a few musical notes coming from inside. Mike is the proprietary service director for Horizon Hobby Distributors*, which distributes JR radio equipment. Mike told me that the tune came from his fast-charger and that it indicated that the battery pack was fully charged.**

**Because I use JR equipment, I was interested in JR's position on fast-charging Ni-Cd packs. Mike said that all of the newer JR and Hangar 9 battery packs (as well as any other packs made with Sanyo cells) can be fast-charged with no ill effects.**

**The system that Mike used consisted of a 12V battery and a Hitec Multi Charge-A-Matic (part no. CG325)—available from your local Horizon dealer.**

## Vendors' Row

**More than 36 vendors set up shop at this year's Festival. Space was available in both a big 200-foot-long tent and along vendors' row. You could buy anything from a T-shirt to a full-size ultralight aircraft. Chances are that if you needed a part for your model aircraft during the Festival, you could find it on vendors' row.**

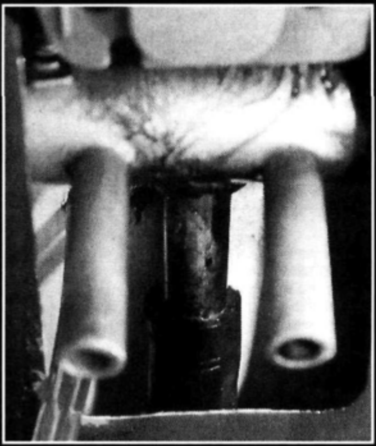
**Raffle sponsors were: Ohio R/C Models, All American Kit Cutters, Stream R/C, Livesay's Tx Trays, Modelair Industries, Carden Aircraft, Jim Meister Fun Scale, Lite-Flyte Products, JDM Products, Propwash Videos, Aerotech R/C Models, A.R.D. Enterprises, The Melrose Co., Lanier R/C, Bell Ltd., Computer Aircraft Design, B&B Specialties, Byron Originals, Futaba, Airtronics, Grant Payne, Hitec, Roto's Hobby Shop, Vendor Wizard, Sir Richard's, Smith-Petty Inc., Bob Smith Industries, Auco Model Supplies, Dan River Mills and Bob Banka's Scale Model Research.**

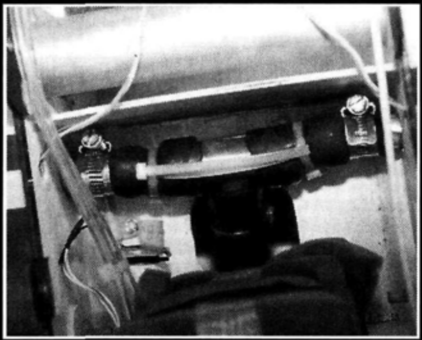
**Local vendors included: Chinqua-Penn, Hipsters, Ruffino's Pizza, J&L Enterprises, Sound Shop, Danville Distributing, Karen's Hallmark, Southeastern Associates, Mr. Madison Davis, Paris, Stanley Furniture, I Diamond Inc., Peanut Shack, The Footlocker, Pepsi, Fox Mfg., Piedmont Mall, The Ground Round and Ray's Flowers & Gifts.**

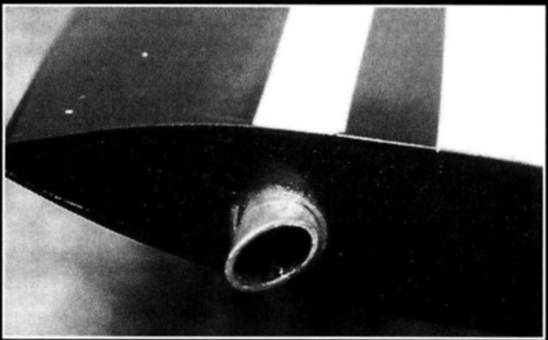
# Wingtip Smoke

Robert Hayes from Baltimore, MD, equipped his ⅓-scale Lanier* Laser with a wingtip smoke system, which was quite simple and worked well. A Zenoah G-62 engine was fitted with a Slimline* muffler, which had a third exhaust pipe installed between the two factory pipes. A short piece of automotive heater hose was used to extend the center pipe into the cabin section of the fuselage. A copper plumbing "T" was installed at the end of the hose so as to line up with the lines coming from the wings. After the wing had been installed, ½-inch aluminum tubes were built into it and connected to the copper "T" with heater hose and clamps. An electric smoke pump was used to power the system.

*Robert Hayes' Lanier ⅓-scale Laser is equipped with a unique smoke system that emits a smoky signature from the wingtips and from the engine's exhaust!*





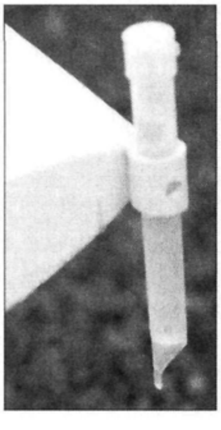


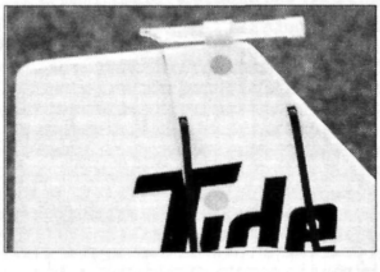
# Fly at Night?

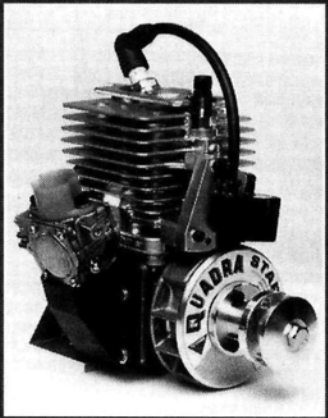
After the thunderstorm on Friday night, Joe Asher, Bill Adams, Dennis Richardson and Mike Hudak put on a demonstration of R/C night flying. Each aircraft was equipped with three Cyalume Light Sticks—one on each wingtip and one on the vertical stab. White, red and green were used to simulate navigation lights. The sticks were slid into plastic mounts, which were attached to the aircraft.


*One of the planes flown by the Delaware trio of Joe Asher, Dennis Richardson and Mike Hudak, who put on flight demos at night! With Cyalume Light Sticks attached to their models, these modelers showed that they were indeed "night qualified"!*

Cyalume Light Sticks are available at sporting goods and hardware stores. Joe says that night flying is a regular event at the flying field at Lums Pond State Park in Newark, DE, and that most landings are pretty good. One nice thing about an airplane that doesn't land on the runway at night is that it's very easy to find, because it's all lit up. The Delaware group fly a wide variety of aircraft at night, including electric gliders, helicopters and giant-scale, gas-powered sport models such as Lanier Stingers.





*The new Quadra 75cc (4.4ci) gas engine looks really good with its Reed Valve Induction (RVI). This and other Quadra-Aerrow engines are available in the U.S. through North American Power R/C Inc.*

# New from Quadra

The new Quadra* 75cc (4.4ci) engine weighs 6.5 pounds and is rated at 8hp. The Q75 and Q65S engines have Reed Valve Induction (RVI). The recommended prop for the Q75S and the Q75SB is a 22x12 or 24x12 respectively. As part of Quadra-Aerrow's "firewall-ready" strategy, all their engines are sold complete with muffler, spark plug, magneto CD ignition, flush firewall mount, throttle linkage, a Q-Start spring starter and even a spark-plug wrench for a battery-ignition system. (Q75 and Q100 engines are also available with a battery-ignition option.)

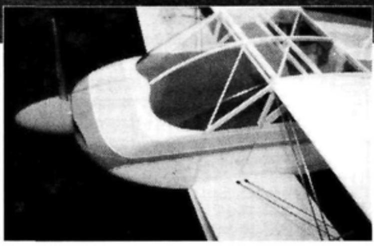
** Addresses are listed alphabetically in the Index of Manufacturers on page 134.*

# SCALE TECHNIQUES

BOB UNDERWOOD

## HOMEMADE SCALE SPINNERS

A GREAT, BIG welcome from the second half of the "Scale Techniques" team; I'm the shorter (and older) half. Often in a first column, the writer attempts to dazzle the reader with credentials. I will not do that, other than to say that I've been scratch-building scale models for 28 years, I've enjoyed some success, and I've managed to borrow techniques from virtually every successful scale modeler around. I'd love to say that I've created a few techniques on my own, but I haven't the foggiest which those would be. And sure as shootin', if I said one was my "invention," someone else would undoubtedly prove that they had used it three years earlier.

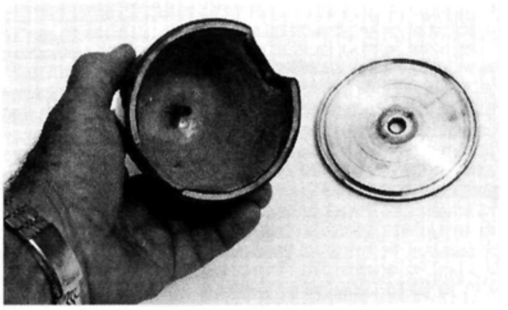


*Bob's 1995 Top Gun entry, the Hiperbipe, is a unique and interesting project. Without the homemade scale spinner, Bob's static score would have been lower.*

**NO SPINNER, NO PROBLEM!**

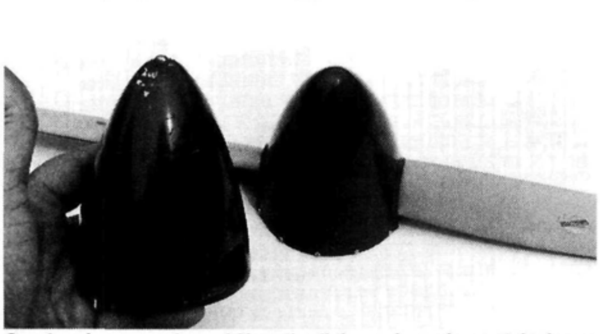
From time to time, scale modelers plant themselves at the newsstand in the supermarket, while their "lifemates" trundle the cart up and down the aisles, accumulating bread, cereal and assorted "stuff." As the modeler thumbs through the various full-scale aircraft magazines, the brain categorizes the featured aircraft. These include "of interest; been there, done that; ugh"; and so forth. One frustrating sub-category that often appears is when, overall, an aircraft fits into "of interest," but has some distinguishing feature that makes it seemingly impossible to recreate accurately. That feature is often the spinner.

"Yep," you say. "It has happened to me a dozen times. I find the perfect aircraft to model, but there is no spinner on the market that comes close to matching the real one." Well, golly gee whiz, why don't you make your own? In a couple of evenings, you can whip out two (one for static, one for flying) with minimal fuss.



*The basic spinner parts—the front balsa cone and a commercially available aluminum backplate. Note the plywood ring that seats in the backplate groove.*

If you think that I'm talking about a metal spinner, scrub that idea. We are making a balsa spinner. Don't get huffy and tell me these don't work, because I have two airplanes that use them, and I wouldn't want the models to become depressed. They work. They don't come apart. You can use a starter. And you can make them any shape and size you want.



*One for show; one for go! Yes, the flying spinner is scratched up a bit, but that's easily repaired.*

**TURNING WOOD**

What do you need in the way of equipment? You can get by with an inexpensive drill press, some files and sandpaper. Actually, a wood lathe is better than a drill press. Maybe you have a friend who has one, or you could take a look around at garage sales. Sears sells a wood lathe for about half the cost of a good engine. Though wood-turning tools are not needed to work balsa, they do make the job easier. The finished product from either a drill press or a lathe is about the same. But with a lathe, it takes less work to make your spinner true.

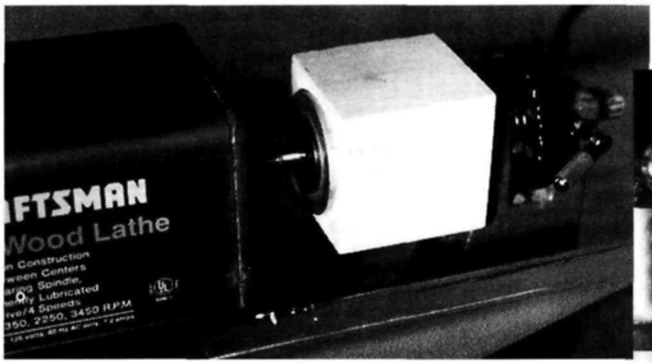
- **Step 1.** Locate a metal spinner backplate that's the correct diameter. If your scrap box doesn't include one, buy one separately. Make sure that it has a locating groove cut into it.
- **Step 2.** Construct a template to use during the shaping process. A piece of stiff cardboard or lite-ply is fine. Determine the proper shape from the view on the drawing.
- **Step 3.** Select a balsa block that is larger than both the diameter of the

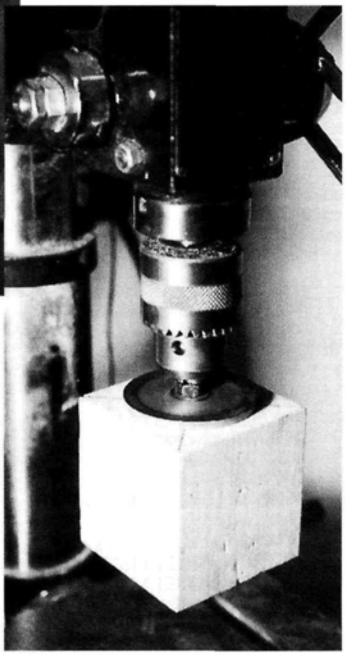

*The back of the static spinner. The nut matches the crankshaft threads so that the assembly doesn't fall off during static judging.*

backplate and the finished length of the spinner. A medium density is fine; very soft or hard density only complicates the task. You may prefer to use four smaller blocks glued together. Actually, gluing blocks together has two advantages. First, it gives you lines on which to align the center of the block. Second, you can arrange the grain in a way that minimizes the tendency for the block to be cut or sanded faster on one side than the other. The grain should run from the backplate to the spinner point. Make absolutely certain the backplate end of the block(s) is square and flat.

• **Step 4.** Carefully cut a ring out of 1⁄8-inch, aircraft-grade plywood that will fit into the groove of the metal backplate. This is a locater piece, so make sure that it fits well. Then center and glue it to the squared-off end of the block. Make sure that it's centered on the face of the block. Next, cut some tiny pieces of 1⁄64-inch ply, and place them inside the backplate groove. Next, put a whole sheet of sandpaper on a flat surface, and sand away the the thickness of the plywood ring that's glued to the balsa block until the block bottoms out on the backplate. When you've done this, remove the 1⁄64-inch pieces from the groove.

• **Step 5A.** If you use a drill press, you will need a bolt or machine screw that is long enough to go through the balsa block and backplate and a nut to secure them. Leave enough length to chuck into the drill press. This may take some fancy detective work, especially if your spinner is more than 3 inches long. Keep the diameter of the bolt the same as, or less than, that of the engine crank. Carefully drill a hole through the balsa block for the bolt. This hole should be dead center and straight, otherwise, you'll have problems making the spinner run true.



***Above: basic lathe setup.***

***Right: basic drill-press setup. You may want to trim the corners before starting to turn for shaping.***

Put the bolt through the block, with the head at the end to be rounded to a point, add the backplate with the ring seated in the groove, and tighten the nut behind the backplate. Chuck the whole mess in your drill press, and start shaping. It's important to use a low speed and to go easy with the shaping. Too much pressure may cause slippage or an out-of-round condition. You need to use something to steady the file or sanding block. Also, check regularly to see that the backplate is running true with no wobble. The threads on the bolt sometimes cause it to seat incorrectly in the chuck.


*The screw center. The backplate is firmly seated against the flange. This is from a Sears Craftsman wood lathe.*

• **Step 5B.** If you use a lathe, the process will be a little faster. When the block(s) is prepared, drill a hole, and glue a piece of hardwood dowel to the center of the backplate end of the block. I suggest a dowel that is about 1 inch long and between 1⁄2 inch and 3⁄4 inch in diameter. Drill a small pilot hole in the dowel, and then screw a "lathe screw center" through the backplate center hole and into the hardwood insert. (If necessary, be certain to shim the backplate hole to the diameter of the screw.) Seat the screw center against the backplate. Place the assembly in the lathe. Run the center point of the lathe tailpiece up against the other end of the balsa block. (It should be located at the center point of the block.) If the balsa tends toward the soft side, you may

wish to use a dowel insert there as well. Use $\frac{1}{4}$-inch diameter, and make certain everything runs true. Happy turning!

• **Step 6.** Before you finish-sand, make certain the plug is about $\frac{1}{32}$ inch to $\frac{1}{16}$ inch undersize. This will allow you to cover it with a couple of layers of fiberglass cloth and resin. Use medium to heavy cloth that is cut in pie-shape pieces for easy handling. Cover the top layer of cloth with a juicy mix of microballoons and resin. Allow it to set, and sand it to the proper shape while running it on the lathe or drill press.

• **Step 7.** Hollow out the inside, and remove the hardwood dowel. The thickness of the wall is not critical. I leave at least 1 inch to $1\frac{1}{2}$ inches of stock in the nose of the spinner with walls that are about $\frac{1}{8}$ inch to $\frac{3}{16}$ inch thick. A piece of brass tube just large enough to fit over the thread of the machine screw holds the spinner to the backplate. It's glued into the hole in the nose of the spinner. The inside end of this tube is reinforced with a couple of layers of fiberglass cloth and resin.

• **Step 8.** Cut the prop openings, and balance the spinner. Finish and paint.

### SOME FINAL NOTES

I've found that these spinners hold up quite well, and that some modelers won't believe that they're balsa. All of mine are on larger engines that run at 10,000rpm or less. They take a starter just fine. True, they scuff up, but then plastic does, too. At least the balsa and cloth combination can be easily refinished.

Balsa spinners must have a downside, but I haven't found one. Perhaps the fact that construction takes some time and energy could be considered a downside. But scale modelers are never lazy, are they? ■

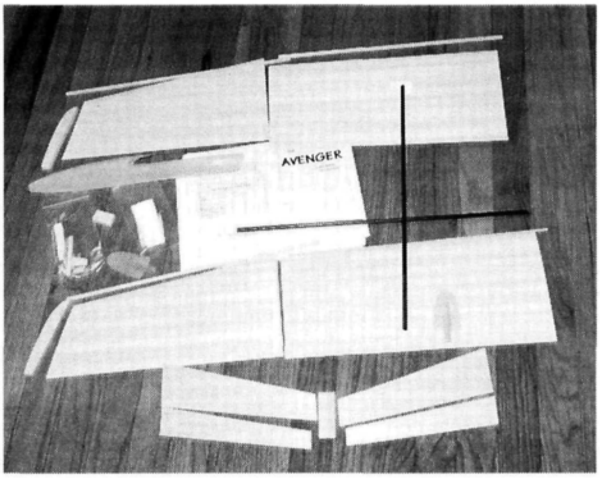
# CENTER ON LIFT

MICHAEL LACHOWSKI

## REVIEW OF AN "A-TAIL"

MY FIRST LOOK at the Avenger was at the Slegers Intl.* booth during the 1995 WRAM show. The first thing that strikes you is how distinctive it looks. From the wing forward, it looks like an ordinary glider, but the tail is quite different. Twin booms extend from the wing's trailing edge and form an upside-down V-tail; let's call it an "A-tail."

Its appearance takes some getting used to. The twin booms look unusual, but they do provide two, nice visual reference lines that you can learn to read for lift or sink conditions. They also make your model easy to pick out among the ubiquitous V-tail HLGs.




*The kit contents: pre-sheeted foam-cores, fiberglass fuselage, booms, hardware and accessories.*

The quality of the kit is excellent. The parts include: pre-sheeted wing panels, tip blocks, basswood leading-edge strips, sheet-balsa tail feathers with a pre-shaped piece that joins the tail halves in the top center, a fiberglass fuselage, carbon-fiber tail booms and fiberglass boom fairings.

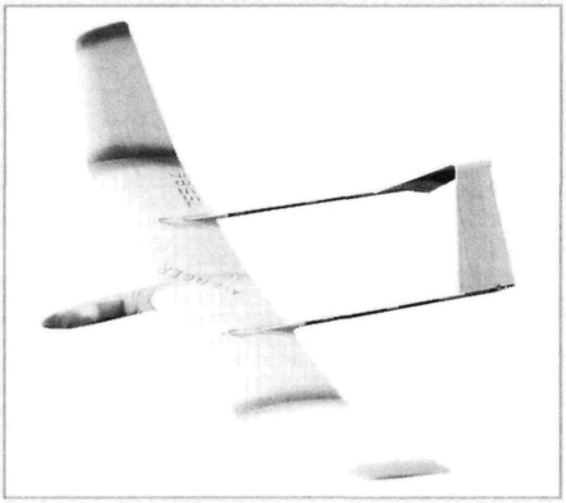
The necessary hardware is included, but you'll need a radio with computer mixing. A good set of instructions and drawings helps to make building straightforward.

### CONSTRUCTION

Wing construction goes quickly, but you have to start out right. First, prepare the holes and slots for the tail booms. This is the only critical alignment you need to make besides joining the wing panels. I made a simple jig to hold the boom perpendicular to the wing panel, and I shimmed the boom to the proper angle relative to the wing.

After the boom mount has been completed, construction is fairly standard. Glue on the basswood leading edge and shape it, then glue on the tip blocks and shape them. Join the panels, and wrap the joints with the fiberglass tape provided in the kit. Use only a minimal amount of glue.

Remember, this is a hand-launch glider (HLG). The basswood leading edge may seem like overkill, but it makes the model very durable.



*The completed Avenger ready for flight. Note the outlines of the receiver and battery in the front of the fuselage.*

## SPECIFICATIONS

**Model name:** Avenger
**Type:** hand-launch glider with twin-boom A-tail
**Designer:** Mark Allen
**Manufacturer:** Allen Development, distributed by Slegers Intl.
**List price:** $165 with pre-sheeted wings
**Wingspan:** 59 in.
**Wing area:** 390 sq. in.
**Wing loading:** 4 to 4.5 oz./sq. ft.
**Weight:** 13.8 oz.
**Airfoil type:** SD7037
**No. of channels req'd:** 2 (ruddervators)
**Radio req'd:** computer radio with V-tail mixing, micro receiver and microservos

**Features:** fiberglass fuselage and wing fairings, carbon-fiber arrow-shaft tail booms. Wings pre-sheeted with obechi. The servo holes have been cut, and the boom-installation locations have been routed. All the necessary hardware and 13 pages of construction notes and drawings are included.

**Hits**
- Pre-sheeted wings make construction go quickly.
- Looks unique in the air with twin tail booms and an A-tail.

**Misses**
- Obechi-sheeted wings make the model heavy for very light lift.
- Wing loading is 5 oz./sq. ft.

Durability is important because HLGs have plenty of midairs and many more landings than conventional models.

Fuselage construction is almost nonexistent. Just glue in the wing hold-down-bolt block, and glue a piece of balsa to the back of the front pod. To prevent the fuselage from being crushed by your killer, HLG throwing grip, glue a few blocks of balsa to the wing (yes, the wing) near the leading edge and mid-chord.

The tail is simple, plain sheet balsa. To form the top of the tail, just tape the stabs into the slotted tail booms, and then tape them to the pre-shaped crown piece. Then install fiberglass fairings on the wing for the booms, and tape the booms to these fairings. The tape makes the booms and tail detachable.

Be sure to reinforce the tail horns with extra fiberglass. If you don't reinforce the horns, they'll break off the ruddervators. Another tip: to prevent the boom fairings from being popped off the wing, wrap an extra piece of fiberglass around the wing's trailing edge.

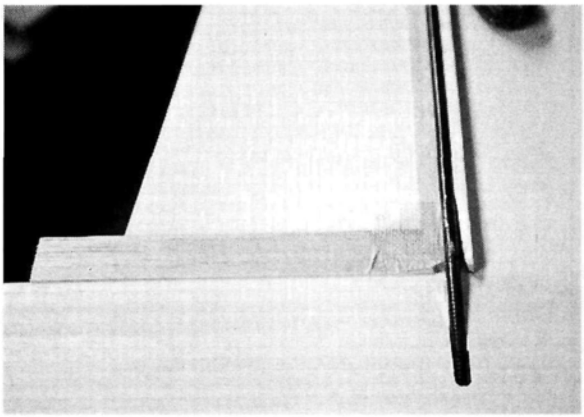
I applied a few quick coats of water-based polyurethane to the wing, and the wing was complete.

### RADIO INSTALLATION

Mount the two ruddervator servos in the wing. Most microservos (such as JR* 341s, Airtronics* 501s, Futaba* 133s and Hitec* HS-80s) will fit. I installed two JR 341s that have leads that are long enough to extend through the center section of the wing without soldering.

In the instructions, the manufacturer implies that conventional V-mixing doesn't work for the radio setup, because the ruddervators don't travel in the same direction as those on a standard V-tail. This is true, but you can plug the left A-servo into the right V-channel and the right A-servo into the left V-channel, and everything will work according to the regular V-tail mixing directions.

The battery and receiver fit inside the fuselage. This means that, to turn the model on and off, you have to remove the wing because switches weigh too much to be used in HLGs. Because this isn't a full-length fuselage, antenna installation can be problematic. The manufacturer suggests that you coil the antenna around a soda straw inside the fuselage. This may work for some radios, but I had range problems using this technique. Do a range check, and use your judgment.



***A simple jig holds the boom at the proper incidence to the wing and at a 90-degree angle to the trailing edge.***

### LAUNCHING

Throwing the Avenger should be easy for pilots who prefer to have finger holes near the trailing edge. The pod and twin-boom design make it unnecessary to have finger holes in the fuselage. Grip the fuselage under the wing with your index finger on the finger block just below the wing's trailing edge. With its 7037 airfoil, the model launches well. Compared with that of a lighter model, the launch height suffers only in calm weather. To point the nose upward after the release, use a little "up" preset.

### FLYING

Flight performance is comparable to that of other current HLGs with similar wing loadings. It doesn't hang like a model with a wing loading of less than 4 ounces per square foot, but it does handle the wind well. After riding a thermal, it travels back upwind very well.

I've enjoyed flying my Avenger. Its unique looks attract plenty of attention at the field. I think it would fly better at a lighter weight but, with pre-sheeted wings, you don't have much control over the weight. Of course, what would be really nice would be to flatten the wing and add ailerons!

** Addresses are listed alphabetically in the Index of Manufacturers on page 134.* ■

## FOAM FUSION

Because most modern sailplanes have multi-taper wings, foam wing-cores have several sections. These wing sections must be joined before you can sheet a wing or vacuum-bag a composite wing skin. But, if you use wooden sheeting, this isn't too critical. Adhesives such as foam-friendly CA or 3M's 77 spray do the job.

Preparation of the cores is critical to obtaining a smooth finished surface. When vacuum-bagging, you want to ensure that no glue gets onto the wing-core surface. Glues can produce a slight ridge at the joint that can't be sanded away. The real solution is to avoid using any glues. But how do you stick things together then? Take advantage of one feature of foam that you often work hard to avoid: various things will melt foam.

One way to join the cores is to spray their ends with CA accelerator. The accelerator softens the cores so that when pressed together, they fuse. Don't use too much and don't get any on the airfoil surfaces, or you'll melt holes in the foam. Now, if you need to lightly sand the joint, the only thing you'll sand is foam, and you won't have any problems with glue lines.

FIELD & BENCH REVIEW

by KEN PETRUCCI & GAIL ROBERTSON

WHEN *Model Airplane News* approached me and fellow R/C'er Gail Robertson about putting together and reviewing the Cox* Katydid, I was somewhat shocked but very pleased to be considered for the task. To be honest, I was more than a little apprehensive about whether I could find time for the project. Having seen the first plane I constructed, the editors assured me that the Cox Katydid was designed for the beginner and that it wouldn't require nearly as much time as my first plane. As a building contractor, I knew I'd be able to assemble the kit, but my biggest challenge as a novice pilot would be to review the flying characteristics.

## CONSTRUCTION

My son, Tyler, was my enthusiastic assistant, and we found that the Katydid went together easily. The overall building time was approximately 4 hours. The parts fit well, and the directions were easy to follow, although the section on sealing the wing-root joint was misleading. A peel-off, stick-on strip wraps around the wing joint. The directions say to use an electric iron on a medium setting to seal the strip. When I did this, the strip became discolored. I don't think an iron is necessary; the directions should mention that the strip can be peeled off.

**• Fuselage and wing.** These crucial components are assembled at the factory, which makes it easy for a first-time builder.

**• Engine.** The engine is a Cox .049 Dragonfly. The fuel-tank space was small, and installing the fuel clunk proved to be difficult. Two friends and I tried unsuccessfully to install it. Then we read the directions. We used a straightened paper clip as a guide wire and inserted it through the fuel clunk, the fuel line and into the open end of the fuel engine inlet hole. Now installation was not only plausible but also easy. Once finished, this gave us a laugh and made us realize just how helpful instructions can be. If all else fails, read the instructions.

## RADIO INSTALLATION

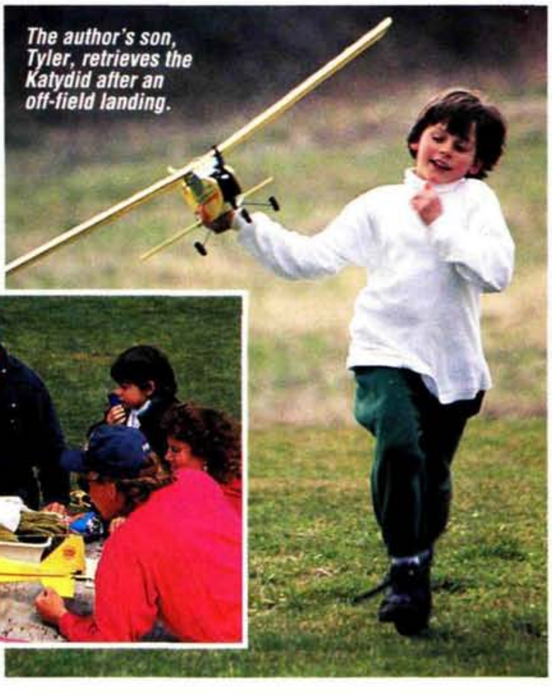
The manufacturer recommends a Cox Cobra 3—a 3-channel radio system that enables all available flight functions to be used. The radio only comes with two servos, however, and a third servo is definitely needed for the throttle. Also, the servo-mounting kit that

PHOTOS BY GAIL ROBERTSON & WALTER SIDAS

COX HOBBIES

# KatYdid

## *The perfect small-field flier*



*The author's son, Tyler, retrieves the Katydid after an off-field landing.*

### SPECIFICATIONS



**Name:** Katydid
**Manufacturer:** Cox
**Type:** ½A trainer
**Wingspan:** 41 in.
**Weight:** 24 oz.
**Length:** 28 in.
**Wing area:** 265 sq. in.
**Wing loading:** 13.04 oz./sq. ft.
**Airfoil type:** Clark-Y
**Channels:** 3
**Radio used:** Cox Cobra 3
**List price:** $180
**Engine used:** Cox Dragonfly
**Prop used**: 6x3 Cox
**Features:** major components are factory-built and covered. High-quality, lightweight balsa construction. Clark-Y airfoil provides good lift and smooth stability. Throttle control and steerable nose gear provide good ground handling. Colorful graphics included, or you can create your own design. Includes all the necessary hardware. The recommended Dragonfly engine meets AMA and FAI noise standards.

**Hits**
- Easy to assemble.
- Straight, warp-free, fully assembled components.
- Colorful design; easy to see in the air.
- Excellent, slow-flying trainer for beginners.
- Quality of the balsa wood and built-up construction are very good.
- Good instruction manual.

**Misses**
- Instructions concerning the stick-on, wing-joint strip aren't clear.

***The contents of the box.***

came with the radio didn't include screws, so you'll need some extra mounting screws. The radio installation took 2 hours.

### PUSHROD INSTALLATION

Because of the model's small size, threading the pushrod assembly through the fuselage proved to be a tricky task at best. Some thread used as an electrician's snake made the job easy. When the clevis pins were installed at the end of the pushrods, we became concerned about the quality of the clevis. Later, our suspicions were confirmed; when we made the final field adjustments to the rudder and elevator, one of the clevis pins snapped under normal pressure.

Overall, the Katydid was easy to build and fun to fly for the whole family. Its lightweight maneuverability makes it a good trainer, especially for the beginner. It also has enough aerobatic ability to make it interesting for the novice.


***The compact radio installation in the Katydid. Plan your installation before you permanently mount things.***

## FLIGHT PERFORMANCE

*We felt that the lush grass field at FLYRC was an appropriate site for the Katydid's first flight. Dave Miles and Roger Post were of invaluable assistance during the final field adjustment and the actual flight analysis. Under their watchful eyes, minor fine-tuning of key components was performed skillfully. Before takeoff, a final radio check confirmed that the control surfaces were functioning properly and that the CG was 1⅞ inch behind the leading edge and well within the manufacturer's specifications.*


***Tyler and his Dad receive some instruction from associate editor Roger Post (left).***

### • Takeoff and landing

During the hand-launch procedures, we were careful not to pull the nose up too high before adequate air speed was attained. A gentle hand on the rudder stick is a must, especially during takeoff, because rudder response is particularly sensitive.

Throughout the day, several landings were performed but, by far, the most memorable event occurred on the second flight. A large rudder input proved to be too much for the glue joint on the vertical-fin assembly. The fin collapsed to the right and laid flat against the stabilizer causing the plane to go into a severe flat spin from an altitude of approximately 50 feet. Dave skillfully saved the Katydid from impending disaster. We used some Pacer* Z-Poxy Quick Set Formula to reset the stabilizer, and it held up throughout the rest of the day. No need to fear landing this beauty; even a dead-stick flat spin resulted in a smooth touchdown.

### • Slow-speed performance

The Katydid was very predictable with no tendencies to tip-stall. At slow throttle and full up-elevator, the plane stalled with only a minor buffet. Smooth, stable glide characteristics make maneuvering easy for the novice pilot. The flat-bottom wing design allows stable flight in heavy crosswind conditions.

### • High-speed performance

Owing to the engine's low power output, high-speed analysis wasn't applicable.

### • Aerobatics

Dave and Roger had the Katydid performing snap rolls, loops, flat spins and barrel rolls. Inverted flight wasn't possible because of the limited amounts of power.

**Addresses are listed alphabetically in the Index of Manufacturers on page 134.* ■

# AMA Class A & B Electric Nationals

## A quiet competition of technology and skill

by TOM HUNT

*Left: Paul Perret (1994 winner) with his new (very large) Lasor 1200—winner of this year's first place in Class B; FAI-40-5t at 100 ounces. Right: Ric Vaughn and son "R/C" with Ric's third-place Class A ship—R-1; own-design wing and tail around a Falcon 550e fuselage; FAI-05-5t geared (Massey-modified) at 50 ounces.*

*Left: Bill Jenkins' very light (38-ounce) Lanzo Bomber took first in both Class A and B Old-Timer. It has a Massey-modified, FAI-05-5t geared. Right: Gerhard Spielmann's beautiful Viking belonged in the AMA museum ½ mile away—not baking in the hot June sun at the contest. Gerhard is your quintessential German machinist; everything must be perfect and must fly!*


PHOTOS BY TOM HUNT

*Left: Tom Hunt with his first-place (Class A) and second-place (Class B) ship, the Defiant. It has an FAI-05-5t geared motor at 40.5 ounces. Right: Don Abramson's Playboy Senior (Leisure kit) being prepared for an official flight.*

THE SECOND OFFICIAL AMA Electric National Championships were held at the AMA facility in Muncie, IN, on June 23, 24 and 25, 1995. Co-sponsored by the National Electric Aircraft Council (NEAC), this most successful event had the honor of being the first national event to be held at this still-under-construction, mega model-flying facility. The events were run on Saturday and Sunday, and Friday was set aside as a day for tune-ups and sport flying electric models.

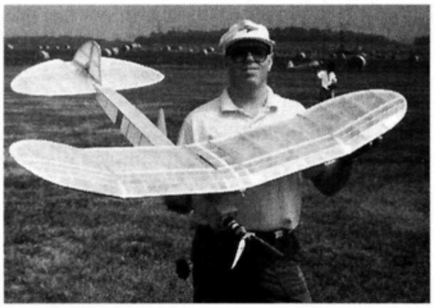
The AMA rulebook outlines each event, so I won't bore you all with the rules; however, each event requires an 8-minute precision flight to be completed within a specified motor run time (different for each event). Three rounds are flown in each event, and the scores in each round are "normalized," i.e., the winner of each round gains 1,000 points, and the other competitors' scores for that round are calculated as a percentage of the winner's scores. Landing bonus points are awarded after normalization.

### THE VICTORS

I took first in this event with my own design—the Defiant. At 40.5 ounces, the model is light for a 96-inch-span model. It sports an unmodified, geared Astro* FAI-05-5t (almost half of the competitors used the modified Astro 05 Stage V from Kirk Massey of New Creations R/C*). In this Class A event, I used a 7-cell 1100mAh pack and a MAP* 13x7½ prop. Plans for this model as well as a fiberglass fuselage are available through Modelair-Tech*, an electric model aircraft company that Bob Aberle and I own.

Wayne Fredette took second place (only 10 points out of 3,000 behind me) with a small, high-wing-loading Sinus kit, available through Hobby Lobby*. Wayne also chose the Astro FAI-05-5t, but he chose to run it direct drive on a 9.5x5 Aeronaut* prop using seven 1000mAh cells. Third place was awarded to Ric Vaughn, flying his home-brew aircraft the R-1, with a Falcon 550e fuselage. At 50 ounces, it was heavier than my model, but it had more wing area than mine and Mr. Fredette's. He chose to use the Massey-modified FAI-05-5t geared motor, but he drove it with seven 1700mAh cells. Any clear pattern here? None that I can find.

In Class B Sailplane, things got even more mixed up for those looking for a clear-cut winning design. First place was garnished by Paul Perret with a new ship called the Lasor 1200 (a larger version of his 1994 Nats-winning ship soon to be kitted by Mr. Perret). This model was big!—136 inches in span. It was driven skyward by an Astro FAI-40-4t geared motor on 10 cells. After a 30-second climb, the model's altitude was by no means the highest of the meet, but with all that wing area and span efficiency, the model just refused to come down! To chop the current to a reasonable level, I reconfigured the Defiant with 10 cells and a smaller prop and managed to obtain second place (although as of this writing, a protest was filed that may force me to give up that place). Glen Poole took third place using his 2-meter-span Mixette—his own design. This model used an FAI-15 geared on eight 1000mAh cells swinging an Aeronaut 14x7. Again, the altitude obtained in 30 seconds was not great, but he did an admirable job of finding lift to win him that place.

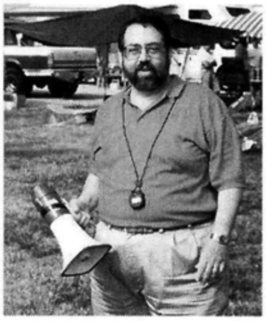


***Author with second-place Class B Old-Timer-winning Kerswap at 43 ounces on 10 cells and a Trinity cobalt dragster motor (geared). Plans available through Modelair-Tech.***

Three distinctly different models and power systems—three winners!

## OLD-TIMERS

Model designs that have been doing well in the Society of Antique Modelers (SAM) contest circuit also did well here. A lightly built Lanzo Bomber by Bill Jenkins took first place in Classes A and B. It is interesting to note that even though the rules allow more than seven cells to be used in Class B, Bill chose to stay with seven and still won against pilots flying significantly higher cell counts and higher climbs! Bill sure could sniff out those thermals! Another light Lanzo Bomber built from scratch by Bob Aberle took third in both Class A and B Old-Timer. Bob, however, did choose to add another cell in Class B to get a little more height for the reduced motor run time (30 seconds—Class B, 45 seconds—Class A). Don Belfort, with a light and well-powered but small Viking, snatched second away from Bob Aberle in Class A Old-Timer. It was interesting to note that Don had trouble getting the Viking down in 8 minutes and was penalized twice for flying longer by 23 seconds in the first round and nearly a minute in his third. Despite this, he still won second place by 120 points over Bob A. Had Don managed his height better, he could have conceiv-




***Clockwise from above left: Wayne Fredette wins second place in Class A with a Sinus kit. It has a direct drive FAI 05 at 50 ounces. • Larry Sribnick—AMA event director, NEAC chairman, president of SR Batteries Inc.—bellowed commands for two days to keep the contest moving. With the help of Steve Anthony, Larry did a very capable job of running the Electric Nats. • Glen Poole with his own design, the Mixette. With its FAI-15 geared, it took second place in Class B. • Bob Aberle's lightweight Lanzo Bomber won third place in both Class A and B Old-Timer. Tom Hunt modified this FAI-05-6t geared.***

| Pos. | Pilot | Plane | Prop | Motor | Cell Type/No. | Wingspan/Area | Poly/Dihedral | Airfoil | Weight (oz.) | Wing/Fuse Matls. |
|---|---|---|---|---|---|---|---|---|---|---|
| **Class A Electric Sailplane** | | | | | | | | | | |
| 1 | Hunt | Defiant | MAP 13.5x7 | Astro FAI-05-5t | 1100 Max/7 | 94 in./660 sq. in. | Polyhedral | SD7032 | 40.5 | Wood/glass |
| 2 | Fredette | Sinus | Aeronaut 9.5x5 | Astro FAI-05-5t | 1000 SCR/7 | 79.5 in./447 sq. in. | Dihedral | E3876 | 50 | Obechi & foam/glass |
| 3 | Vaughn | R-1 | Aeronaut 14x7 | Astro/Massey 05 | 1700 SCRC/7 | 92 in./700 sq. in. | Dihedral | SD7037 | 50 | Obechi & foam/glass |
| **Class B Electric Sailplane** | | | | | | | | | | |
| 1 | Perret | Laser 1200 | Aeronaut 12x7 | Astro FAI40 4T | 1700 SCRC/10 | 136 in./1,118 sq. in. | Polyhedral | SD7037 | 100 | Obechi & foam/glass |
| 2 | Hunt | Defiant | Aeronaut 10.5x6 | Astro FAI-05-5t | 1100 Max/10 | 94 in./660 sq. in. | Polyhedral | SD7032 | 43.5 | Wood/glass |
| 3 | Poole | Mixette | Aeronaut 14x7 | Astro FAI 15 | 1000 SCR/8 | 79.5 in./625 sq. in. | Polyhedral | Clark-Y | 46 | Wood/wood |
| **Class A Electric Old-Timer** | | | | | | | | | | |
| 1 | Jenkins | Lanzo | Aeronaut 13x6.5 | Astro/Massey 05 | 1400 SCR/7 | 72 in./702 sq. in. | Polyhedral | Under-cambered | 38 | Wood/wood |
| 2 | Belfort | Viking | Sonic Tronic 12x7 | Astro/Massey 05 | 1100 Max/7 | 63 in./540 sq. in. | Dihedral | Under-cambered | 35 | Wood/wood |
| 3 | Aberle | Lanzo Bomber | Zinger 12x10 | Astro FAI-05-6t | 800 Max/7 | 70 in./682 sq. in. | Polyhedral | Under-cambered | 36 | Wood/wood |
| **Class B Electric Old-Timer** | | | | | | | | | | |
| 1 | Jenkins | Lanzo Bomber | Aeronaut 13x6.5 | Astro/Massey 05 | 1400 SCR/7 | 72 in./702 sq. in. | Polyhedral | Under-cambered | 38 | Wood/wood |
| 2 | Hunt | Kerswap | Aeronaut 10.5x6 | Trinity 18T Cobalt | 1100 Max/10 | 63 in./700 sq. in. | Polyhedral | Under-cambered | 43 | Wood/wood |
| 3 | Aberle | Lanzo Bomber | Zinger 12x10 | Astro FAI-05-6t | 800 Max/8 | 70 in./682 sq. in. | Polyhedral | Under-cambered | 37 | Wood/wood |

*AMA/NEC Electric Nats '95 Technical Specifications of winning aircraft in each event
Information courtesy of Larry Sribnick, AMA event director, chairman National Electric Aircraft Council (NEAC), president of SR Batteries Inc.

ably taken first from Bill Jenkins.

I managed a second place in Class B Old-Timer with my 4-year-old Kerswap (plans available from Modelair-Tech). This design does very well in ½A Texaco (ugh!—glow fuel!) and in electric LMR and, over the years, it has helped me win a few trophies in SAM competitions. The model could be lighter, but it has good climb with a modified Trinity* cobalt drag motor with an Astro gearbox up front.

So, there you have it. Class A and B Sailplane is wide open in terms of model designs and equipment. Class A and B Old-Timer may be more strictly defined as far as model designs are concerned. A Lanzo Bomber is still a favorite and consistent winner. When properly powered, my 630-square-inch Kerswap or a slightly larger Viking (most of the Vikings at the Nats were kit-built at 540 square inches) are good competitors.

The distinction between the Class A and B sailplane and old-timer events is that the old-timer models are rarely flown; they are guided. Remember, they were designed as "free-flighters" back in the '30s and early '40s, and they fly better if left alone. The modern R/C sailplanes were designed to be flown; if the air is no good where you are, go somewhere else! Sailplanes love to travel; generally, old-timers don't. With most old-timer designs, too much altitude is lost trying to go from thermal to thermal. The Lanzo Bomber is the exception, and that's probably why it does so well in this event.

## Curious Statistics

| | % OF AIRCRAFT |
|---|---|
| • Scratch-built from plans or original design | 75 |
| • Using an Aeronaut prop | 66 |
| • Using AstroFlight motors | 44 |
| • Using AstroFlight 05 motors with Massey Stage V mods | 92 |
| • Using gear drive | 92 |
| • Using BEC (battery-eliminator circuitry) | 83 |
| • Using Sermos* connectors | 100 |
| • Using SR* battery packs | 50 |
| • Using Sanyo* packs | 50 |
| • Using polyhedral wing | 66 |
| • Using rudder/elevator control only | 66 |
| • Lanzo Bomber entrants in old-timer events | 66 |

| | NUMBER OF ENTRANTS |
|---|---|
| • Class A Sailplane LMR (610) | 19 |
| • Class B Sailplane LMR (612) | 13 |
| • Class A Old-Timer LMR (618) | 13 |
| • Class B Old-Timer LMR (620) | 6 |
| * Total number of flights flown in competition | 150 |

*Compiled by Larry Sribnick, AMA event director, NEAC chairman and president of SR Batteries Inc.*

## SPOT-LANDING HEADACHES

At the conclusion of a flight, the pilot was awarded an extra 10 points if the nose of the model came to rest within a 25-foot-diameter circle. No pieces could come off the model except for a broken prop, and a model could not be damaged to a point where it could not be flown without repairs. A 25-foot circle is a rather small spot to hit consistently. Of all the pilots that placed, bonus points were awarded only 35 percent of the time. Of all the pilots who flew in the contest, bonus points for spot landings were awarded 28 percent of the time. Although my own spot-landing percentage was higher than most (58), I felt that, in this case, hitting the spot and risking damage to the aircraft was not worth the extra 10 points. If the bonus had been higher, maybe more spot landings would have been made. On the other hand, we might have had fewer competitors because of terminally broken models.

Hitting-the-spot techniques varied with the type of model flown. The old-timer models, which had landing gear, were easier to stop in the grass at the spot; however, if the model was too low and too far away on approach (like the sleek sailplane types), the glide could not be stretched. Energy management and "knowing the model" became more important to hitting the spot in the old-timer events. In these events, the top three competitors hit the spot landings 55 percent of the time.

Most of the sailplanes had no lift-dumping or drag-producing devices to help them hit the spot. Also, no one attempted to slow the models when they hit the ground (like they do in many pure sailplane model designs). Although "stretching the approach" is easier with pure sailplane models, most aircraft overshot (not undershot) the spot. Many pilots came in too fast and skidded right through the landing circle. Bonus points in both sailplane events were awarded only 39 percent of the time to the top three pilots.

## LESSONS LEARNED

What have I learned from this enlightening national competition? Pilot skill might eventually dominate the electric sailplane and electric old-timer events as it has dominated pure sailplane events. But this might not happen if one of two things happens: the rules reduce motor run times to make it more difficult to get the 8-minute max or the duration is increased without affecting motor run time; or, power-systems technology (motors/batteries) continues to develop at the pace it has in the last five years.

If either of these things happens, modelers will have to continue to experiment to find a new combination that will make their models go higher and faster and stay aloft longer than the next pilot's. This challenge is open to all pilots, regardless of skill levels. Less technical modelers can imitate what more experienced modelers have learned. The more technical pilots are always sharing this information with the modeling community through the major model magazines.

I think that it is better to have separate Class A and B ships. Some pilots lost their only models during the Class A rounds, and they couldn't be repaired for Class B on Sunday. In the future, I may gravitate toward a larger "B" ship as Paul Perret did with his Lasor 1200, although I may develop a model for an Astro FAI-25-5t geared motor on a 900 to 1,000 square-inch, all-wood, lightweight Class B ship for next year. So, watch out!

Currently, the spirit of electric aeromodeling promotes the sharing of knowledge. Very few people keep secrets—probably because the rapid changes in technology allow pilots to go find the "next secret" for the next contest "ad infinitum." It takes a lot of work to stay ahead, and I often find that I can be beaten by a four-year-old Electra, motor and battery.

The many variables in electric model "sailplaning" create an environment in which average modelers can invest as little or as much as they want and compete successfully. Even though technology changes quickly, thermals and aerodynamics don't! Fly the model you have until you know it well. When you have done that and know that you can do better, design or build that new model with all the "newest technology" that you can afford. Go out and fly the new model until it screams for mercy. Jumping on the bandwagon of a winner can sometimes be like cheating off the worst student in the class!

** Addresses are listed alphabetically in the Index of Manufacturers on page 134.* ■

HOW TO

*Understanding forward-wing and foreplane designs*

Part 1

# Canards, Tandem Wings and Three-Surface Design

by ANDY LENNON

HISTORY REPEATS itself. The first successful powered flights were made by canards; subsequent designs incorporated both a canard foreplane and a tailplane behind the wing, i.e., three surfaces.

Eventually, the wing and rear tail versions predominated, and they're now the conventional configurations. Recently, however, largely owing to Burt Rutan's efforts, the canard, the tandem-wing and the three-surface versions have reappeared (Figure 1). Today, Burt's latest designs are more conventional, but still unique, and in this three-part series, I'll discuss the design of these three configurations.

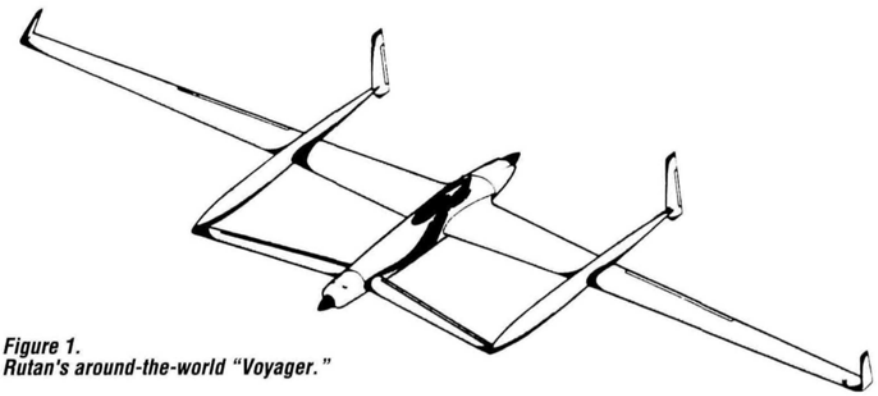


***Figure 1.*** ***Rutan's around-the-world "Voyager."***

**Advantages**

- **Increased safety.** For well-designed, full-scale canard, tandem-wing and three-surface aircraft, the major advantage of their design is that it frees them from the too-often-fatal, stall-spin-at-low-altitude crash. Though the foreplane may stall, the main wing does not.
- **Shared load; reduced main-wing area.** In a conventional aircraft, the wing does all the work; the horizontal tail is lightly loaded (downward in most cases) and simply controls the wing's angle of attack (AoA). On these three types of front-wing aircraft, their forward surfaces work hard and share the load with the main wing, which may, as a result, have a reduced area.
- **Main wing spar may be out of the way** at the rear of the cabin; the conventional version's spar goes through the cabin and interferes with passenger seating (particularly true of low- and mid-wing types).
- **Smaller, lighter, more compact airplane**—achieved by dividing the required wing area between two lifting surfaces.

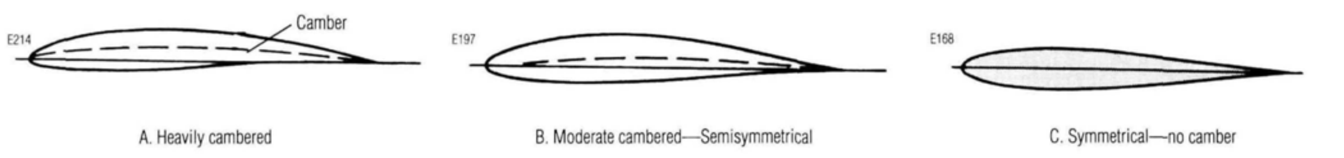



***Figure 2. Broad types of airfoil sections.***

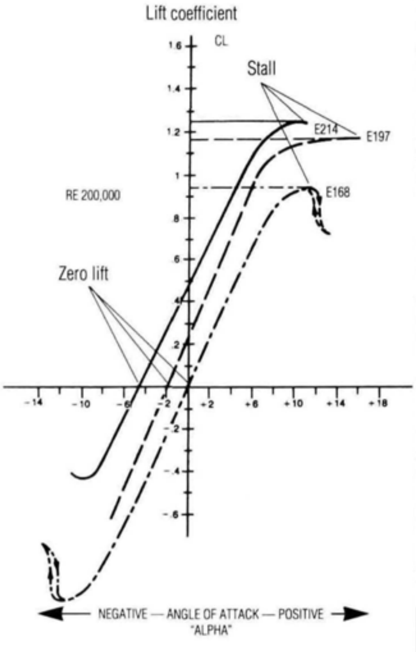



*Figure 3. Lift curves of three airfoil types.*

### Disadvantages

• **Heavily loaded foreplane.** For stability, the foreplane must be much more heavily loaded (in terms of ounces or pounds per square foot of wing area). The foreplane's loading controls the aircraft's stall speed, which is considerably higher than the main wing's stall speed. Canard and tandem-wing types take off and land faster and need a longer runway than conventional aircraft. The three-surface design is better in this respect because its foreplane loading may be reduced, but three surfaces mean more interference drag.

• **Limited aerobatic capabilities.** The high foreplane loading, combined with the inability to stall the aft wing, limits the aerobatic capabilities of these three classes. (See "Wing Loading Design," *Model Airplane News,* August 1992.)

## AIRFOIL SELECTION

For all three types of forward-wing aircraft, airfoil selection is very critical. There are three broad categories of airfoil (see Figure 2):

• heavily cambered—E214;
• moderately cambered—E197;
• no-camber, symmetrical type—E168.

Figure 3 compares lift with AoA curves for these three airfoils. Note that, though the heavily cambered E214 stalls at a lower AoA, it starts lifting at a higher *negative* angle than the other two. The symmetrical E168 starts to lift only at a positive angle, and its maximum lift coefficient is the lowest of all three. Figures 4, 5 and 6 show their section characteristics.

Since all three configurations have both forward and main wings sharing the lift,

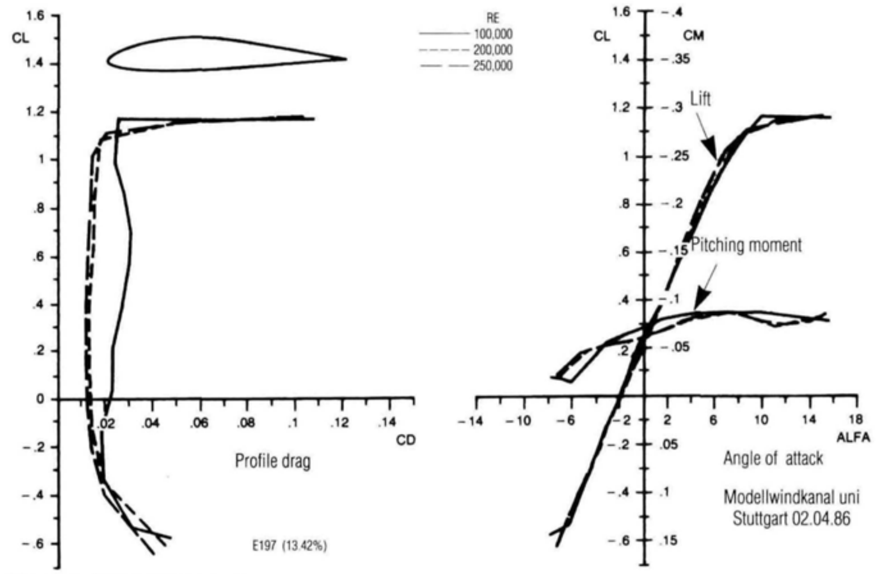



*Figure 4. E197 airfoil chart.*

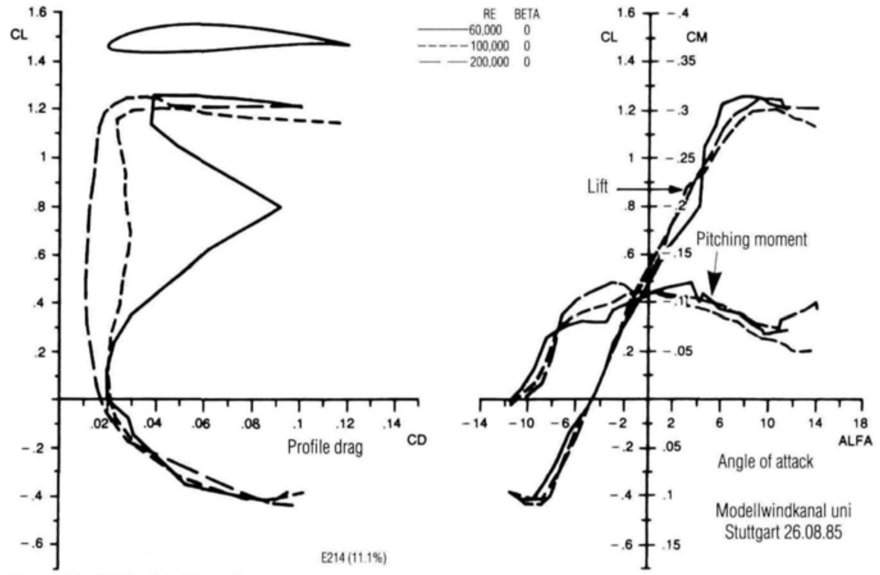



*Figure 5. E214 airfoil chart.*

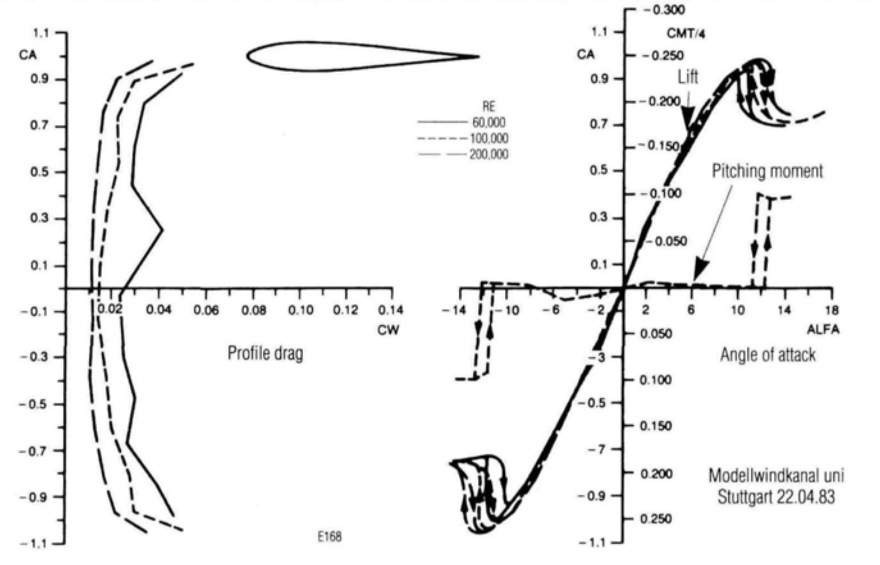



*Figure 6. E168 airfoil chart.*

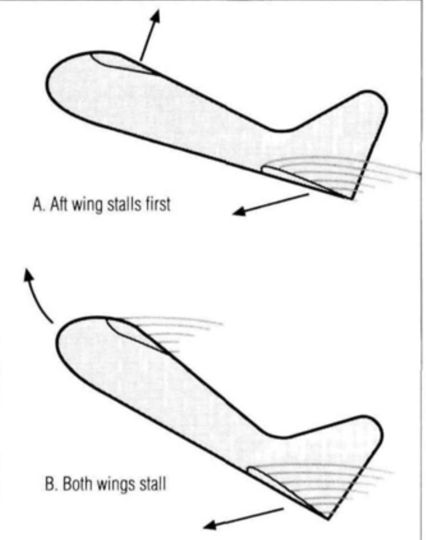



**Figure 7. Nose-up pitch as aft wing stalls first.**

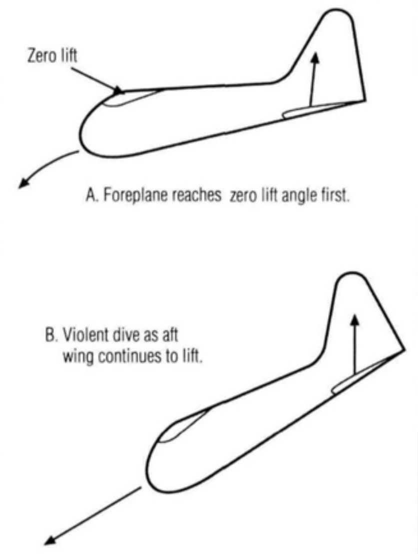



**Figure 8. Steep dive as foreplane hits zero-lift angle first.**

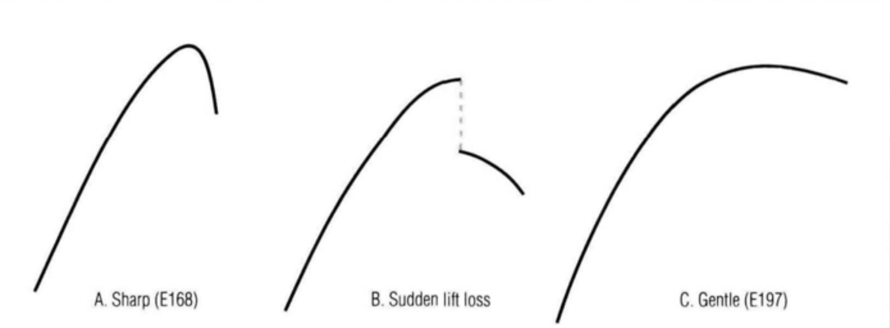



**Figure 9. Types of airfoil stalls.**

two requirements are of *critical* importance for successful, stable flight:

• The front wing *must* stall before the main wing stalls. If the main wing stalls first, the scenario depicted in Figure 7 will result; at low altitude, a crash is inevitable.

• The main wing *must* arrive at its angle of zero lift before the foreplane achieves zero lift. If the foreplane ceases to lift while the main wing still lifts, the behavior shown in Figure 8 results.

With these considerations in mind, look again at Figure 3. Obviously, airfoil E214 would be an excellent choice for the front wing. Its early stall and high *negative* angle of zero lift satisfy both requirements, and its stall is gentle.

For the main wing, airfoil E197 would again be excellent. Its higher angle of attack at the gentle stall and its lower *negative* angle of zero lift comply with both mandatory requirements. E168 would not be suitable for either front- or main-wing airfoils, but it would be a good section for the horizontal tailplane of a three-surface design.

An airfoil's stall pattern at $C_L$ max and at the wing's flight Reynolds number (Rn) is another important consideration. Figure 9 shows three types of stall:

A. Sharp, as in E168, with hysteresis;
B. Sudden lift loss;
C. Gentle, as for E197.

Obviously, for a canard or tandem-wing foreplane to have A- or B-type stalling airfoils invites trouble. In the landing flare, if the foreplane were to stall suddenly, landing would be very hard and would probably damage the nose-wheel landing gear.

For the three-surface airplane with a horizontal tail and elevators, a sharp foreplane stall is desirable to prevent up-elevator action from stalling both the front and main wings. Elevator action would prevent a sudden nose drop. Figure 10 shows the

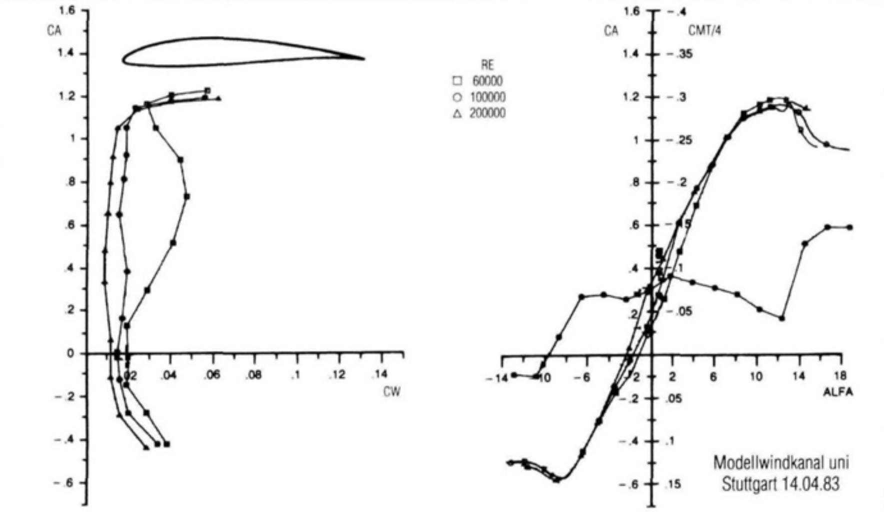



**Figure 10. E211.**

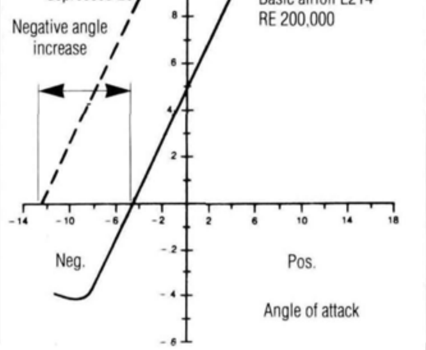



**Figure 11. Impact of a 40% chord slotted flap deployed to a 20° on section E214.**

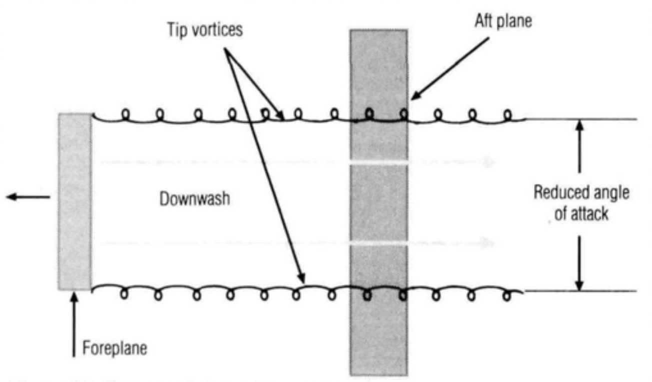



***Figure 12. Downwash impact on a canard.***

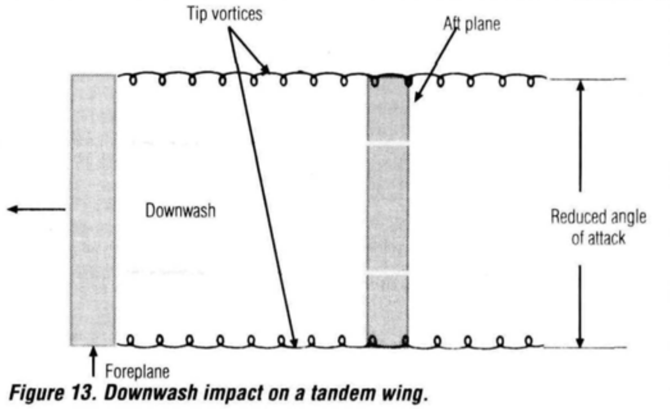



***Figure 13. Downwash impact on a tandem wing.***

Eppler E211—a foreplane airfoil with a sharp stall at low Rn. Note the reduction in the negative angle of attack of zero lift as the Rn is reduced.

Figure 11. Using slotted flaps on the foreplanes of canard and tandem-wing models for pitch control has three effects:

- The stall angle is reduced.
- The *negative* angle of zero lift is increased.
- $C_L$ max is increased substantially.

## REYNOLDS NUMBERS, ASPECT RATIO AND PLANFORM

High aspect ratios reduce the stalling angle (desirable for foreplanes) but result in lower Rns, particularly at landing speeds. Chords of less than 5 inches are to be avoided. (For more on these subjects, refer to "Airfoil Selection," *Model Airplane News*, May, June '92.)

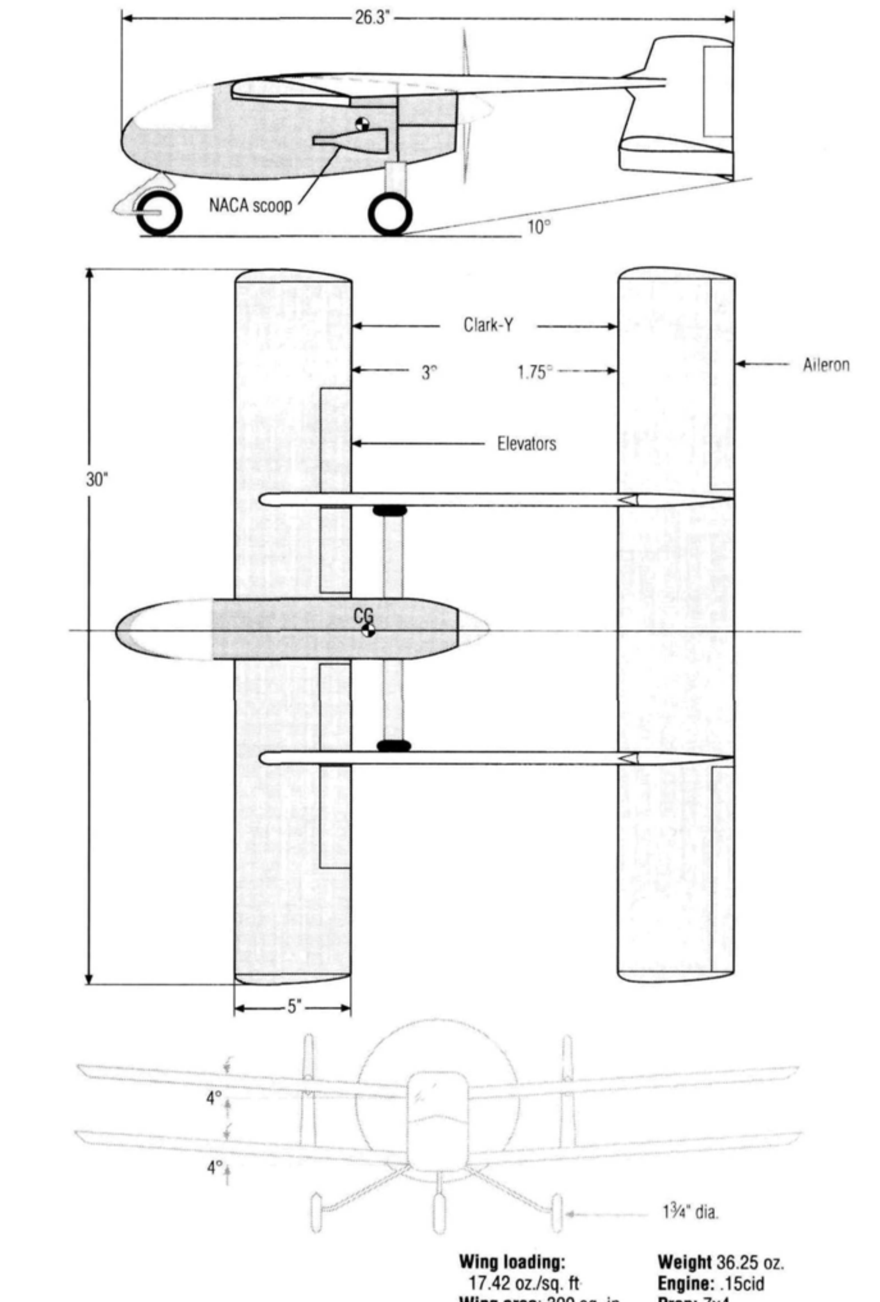
Low aspect ratios increase the stalling angle (desirable for the main wings) of all three types. Shorter main wingspans improve roll response.

A mild forward sweep on the foreplane promotes root-stalling first (see "Wing Design," *Model Airplane News*, January, February, March '93). The result is a gentle, progressive stall as the angle of attack increases. Such forward sweep should not exceed 5 degrees on the 1/4 MAC line. On a three-surface design, forward sweep would also benefit the horizontal tailplane.

## DOWNWASH AND TIP VORTICES

Downwash is thoroughly discussed in "Horizontal Tail Incidence" (*Model Airplane News*, September '95), and charts for estimating downwash angles are provided. Each of the three, forward-wing aircraft is affected by downwash.

- **Canards:** foreplane downwash impacts on a portion of the aft wing (equal in span to that of the foreplane), reducing the angle of attack and lift in the downwashed area (Figure 12).




**Wing loading:** 17.42 oz./sq. ft
**Wing area**: 300 sq. in.
**Weight** 36.25 oz.
**Engine:** .15cid
**Prop:** 7x4

***Figure 14. Wasp tandem-wing biplane (pusher).***

## CANARDS, TANDEM WINGS AND THREE-SURFACE DESIGN

- **Tandem-wing aircraft:** the whole span of the aft wing is similarly affected (Figure 13).
- **Three-surface models:** the main plane is affected as in the canard (Figure 12); and the horizontal tail is affected by the downwash from that portion of the main wing that's "shadowed" by the foreplane downwash. The reduced angle of attack of the "shadowed" portion of the main wing may be compensated for as follows:
- For tandem wings of equal span: for level flight at the designed cruising speed, the aft wing's angle of attack should be increased by the downwash angle generated by the foreplane.
- For canards and three-surface airplanes: shadowed portions of the main wing should have an increase in AoA that's equal to the foreplane's level-flight downwash angle. The part of the wing that's out of downwash is left at the angle of attack calculated to produce adequate lift. This calls for a "jog" in the wing and was used on the Swan.

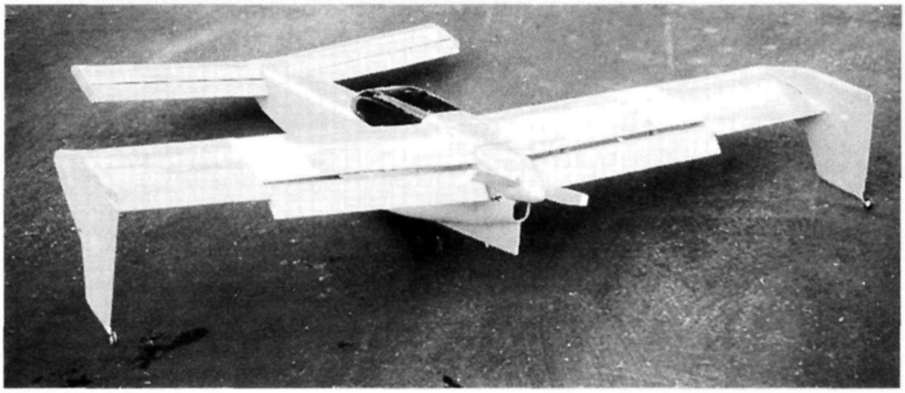


***Figure 15. Swan canard pusher.***

A variation of this is to use the NACA droop (*Model Airplane News*, June 1990) for that part of the wing that's out of downwash, so that the inboard ends of the droop are just behind the foreplane tips.

A simpler method, where the foreplane span is roughly half that of the main wing, is to increase the whole main wing's angle of attack by half the foreplane level-flight downwash angle. The main wing outboard portions will have higher lift coefficients, closer to the stall. The Canada Goose (Figure 16) used this method.

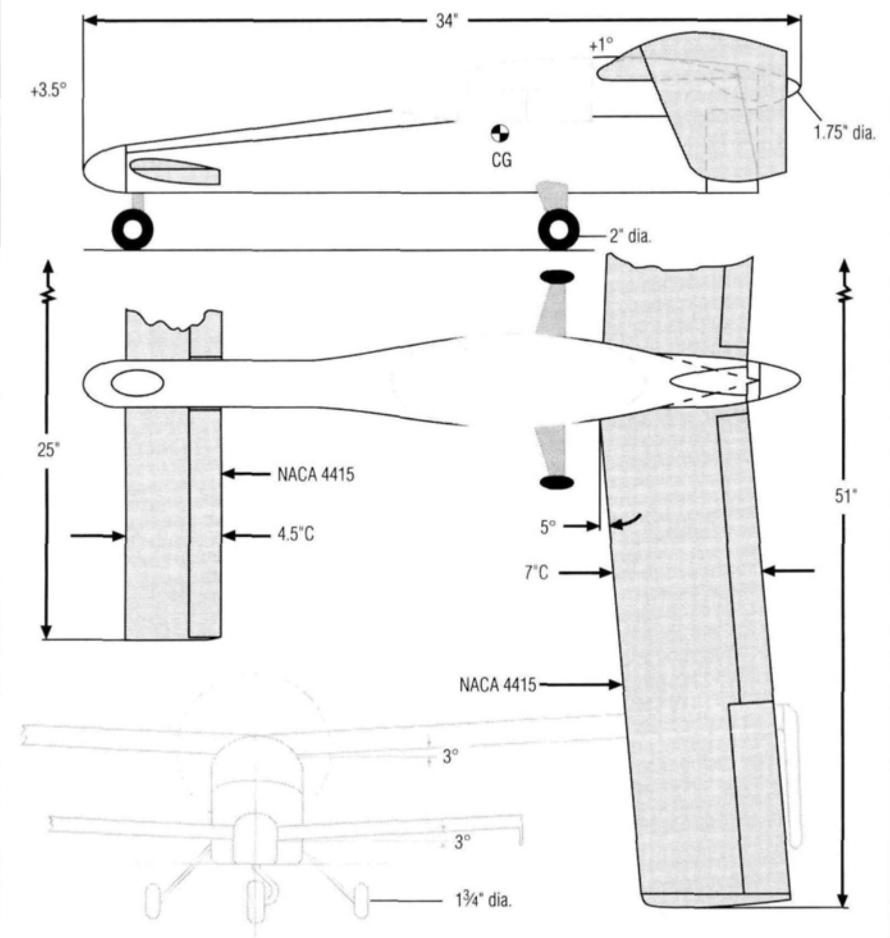
A third method is wing washout with increased root AoA and reduced tip AoA. An accurate built-in twist is needed, but it results in an increase in wingtip stall margin and is stabilizing on a swept-back main wing.

In all cases, the net lift should equal the calculated lift needed.

To avoid the impact of foreplane-tip vortices on the main wing, a vertical gap between foreplane and main plane of half the aft wing's MAC is suggested. Either the foreplane low and the main plane high, or the reverse may be used. The foreplane-tip vortices will then pass under or over the main wing. Longitudinal separation or "stagger" between ¼ MAC points of each wing (of two to three times the aft wing's MAC) is appropriate for canards and tandem wings.

For the three-surface design, it is suggested that the horizontal tail be "T"-mounted on the fin where it will be more effective, and that the stagger be one to two times the aft wing's MAC.

Part 2 will continue with a design approach. ■




**Gross weight:** 75 oz.
**Wing area:** 444 sq. in.
**Wing loading:** 24.3 oz./sq. ft.
**Engine:** .35cid
**Prop:** 10x6 pusher
**Power loading:** 215 oz./cid

***Figure 16. Canada Goose canard pusher.***

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**New Creations R/C**, P.O. Box 496, County Line Rd., Willis, TX 77387; (409) 856-4630; fax (409) 856-4630.

**Nick Ziroli Models**, 29 Edgar Dr., Smithtown, NY 11787.

**Ni-Starter**; distributed by McDaniel R/C, 1654 Crofton Blvd. Ste. 4, Crofton, MD 21114; (410) 721-6303; (410) 721-6306.

**O.S.**; distributed by Great Planes Model Distributors, P.O. Box 9021, Champaign, IL 61826-9021; (217) 398-6300; fax (217) 398-1104.

**Pacer Technology**, 9420 Santa Anita Ave., Rancho Cucamonga, CA 91730.

**Precision Eagle**, distributed by Planes Plus, 5 S. 470-B Scots Dr., Naperville, IL 60563; (708) 416-6940.

**Quadra-Aerrow Inc.**, P.O. Box 183, 1881 Rogers Rd., Perth, Ontario, Canada K7H 3E3.

**Sachs**; distributed by Planes Plus, 5 S. 470-B Scots Dr., Naperville, IL 60563; (708) 416-6940.

**Sanyo**, 2001 Sanyo Ave., San Diego, CA 92173; (619) 661-6620; fax (619) 661-6743.

**Sermos R/C Snap Connectors Inc.**, Cedar Corners Station, Box 16787, Stamford, CT 06905.

**Slegers Intl.**, Rt. 15, Wharton, NJ 07885; (201) 366-2525; fax (201) 366-0549.

**Slimline Mfg.**, P.O. Box 3295, Scottsdale, AZ 85271; (602) 967-5053; fax (602) 967-5030.

**Solartex**; distributed by Global Hobby Distributors, 10725 Ellis Ave., Fountain Valley, CA 92728; (714) 964-0827; fax (714) 962-6452.

**SR Batteries Inc.**, Box 287, Bellport, NY 11713; (516) 286-0079; fax (516) 286-0901.

**SuperTigre**; distributed by Great Planes Model Distributors, P.O. Box 9021, Champaign, IL 61826-9021; (217) 398-6300; fax (217) 398-1104.

**Trinity Products**, 1901 E. Linden Ave. #8, Linden, NJ 07036; (908) 862-1705; fax (908) 862-6875.

**Ultracote**; distributed by Carl Goldberg Models, 4734 W. Chicago Ave., Chicago, IL 60651; (312) 626-9550.

**Varsane Products**, 546 S. Pacific St., Ste. C-101, San Marcos, CA 92069; (619) 591-4228; fax (619) 591-9211.

**Woodpecker**; distributed by Unique Model Products, P.O. Box 2229, Lake Arrowhead, CA 92352-2229; (909) 336-5602.

**Zap**; distributed by Pacer Technology (see address above).

**Zenoah**; distributed by Indy R/C, 10620 N. College Ave., Indianapolis, IN 46280; (800) 338-4639.

**Zinger**; distributed by J&Z Products, 25029 S. Vermont Ave., Harbor City, CA 90710.

# NAME THAT PLANE

## CAN YOU IDENTIFY THIS AIRCRAFT?

If you can, send your answer to *Model Airplane News*, **Name That Plane Contest** (state issue in which plane appeared), 251 Danbury Rd., Wilton, CT 06897.


CONGRATULATIONS to M.G. Amesbury of Eagle Point, OR, for correctly identifying the August '95 mystery plane. The Westland Widgeon Mk I was made of spruce, plywood, duralumin tube and fabric covering. It had a folding wing that was hinged at the rear spar and could be folded backward for storage and transportation. The wing halves' maximum chords and thickness were at ⅖ half-span from the center line; the struts were also attached at these points. The large ailerons doubled as flaps that helped to slow the plane to its minimum speed of 40mph.

The 21-foot-long Widgeon Mk I had a 30-foot, 8-inch wingspan. Its height was 7 feet, and its wing area was 145 square feet with a 6.31 pounds/square foot wing loading. With an empty weight of 575 pounds and a gross weight of 915 pounds, its maximum speed was 72mph, and its minimum speed was 40mph. The friction-damped-spring-type undercarriage prevented the spring from being stretched to its full length on bounced landings. The Widgeon Mk I was used as a light aircraft in 1924. ■

The winner will be drawn four weeks following publication from correct answers received (on a postcard delivered by U.S. Mail), and will receive a free one-year subscription to **Model Airplane News**. If already a subscriber, the winner will receive a free one-year extension of his subscription.

## ADVERTISER INDEX

# CLUB OF THE MONTH

**ALASKA RADIO CONTROL SOCIETY**

P.O. Box 756, Girdwood, AK 99587

The active members of the Alaska Radio Control Society (ARCS)—AMA charter 1998—put out a great newsletter. It's filled with witty commentary, helpful hints, excellent photographs and, above all, humor. This group of 160 dedicated pattern fliers is led by president André Leblanc, and Joe Ostrom puts the newsletter together.

"Yup! Old Clem is definitely in R/C decline [RCD] now. Won't be long until he's collecting stamps or taking his wife to the mall. Don't think RCD can't happen to you," quips Bob Stephens, and he gives members a quiz by which they can assess whether they've started to "decline." It's serious stuff, folks! Do you go to the mall with your wife, or—even worse!—watch "Seinfeld" when you have a half-completed model on your workbench? Uh, oh...! A high score means you're "a goner," and "Your kids are probably calling you 'daddy' again!" But there is a remedy: at the first sign of RCD, buy yourself a new computer radio!

Note the club's location; it means that "Next-day air" delivery really never is and that supplies aren't readily available to club members. They buy fuel as a group from Powermaster, and the May newsletter assures them that the next fuel order is on its way and will reach Anchorage in three weeks!

The 20-page ARCS newsletter really is a class act. We found the short column about the National Resource Agency and its request for information about recent moose poaching near the club's field of particular interest. Yes, modelers really are a diverse group!

Congratulations! You're our "Club of the Month," and two subscriptions to *Model Airplane News* are on their way to you (should arrive early in '96?)! ■

# PRODUCT NEWS

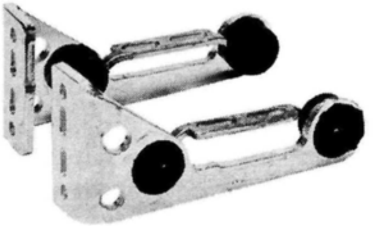
K&A MODELS UNLIMITED

## Honest-Scale War Bird Series

These power slope-scale kits come with epoxy fiberglass fuselages, foam-core wings, clear, vacuum-formed, raised-line canopies and accessories. All necessary planking wood, hardware, a blueprint and instructions are included. Now available are a 50-inch-span P-38 Lightning, a 38-inch-span P-40 Warhawk and a 36-inch-span P-51D Mustang.

**Part nos.**—10112 (P-38), 10113 (P-40), 10114 (P-51D); **prices**—$324.95, $199.95, $199.95.

**K&A Models Unlimited,** 6059 Faculty Ave., Lakewood, CA 90712; (310) 804-0006; fax (310) 804-5092.



SULLIVAN PRODUCTS

## Dynamount

This light, strong engine mount has rubber vibration dampers that are permanently bonded to its steel mounting plate and aluminum beam. It's very easy to install; no drilling or tapping is necessary, and you can easily retrofit it to an existing model. For more information and a complete catalogue, write to Sullivan.

**Part nos.**—S342 (.35 to .65 2-stroke engines), S343 .60 to 1.50 2- and 4-stroke engines).

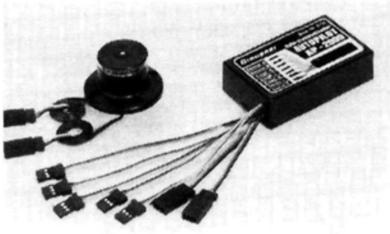
**Sullivan Products,** P.O. Box 5166, Baltimore, MD 21224; (410) 732-3500; fax (410) 327-7443.

WINDSOR PROPELLER CO.

## Master Airscrew Propellers

Three new sizes have been added to the Scimitar Profile Series: 13x6, 13x8 and 14x8. Made of injection-molded, glass-filled nylon, the efficient scimitar-shaped, undercambered blades have sweptback tips and develop greater thrust at lower rpm. Scimitar Series props are available in more than 18 sizes; for a free brochure, send an SASE to Windsor Propeller Co.

**Windsor Propeller Co.,** 3219 Monier Cir., Rancho Cordova, CA 95742; (916) 631-8385; fax (916) 631-8386.



HOBBY LOBBY INTL.

## Opto-Autopilot

By sensing the difference between the darkness below and the brightness above the horizon 360 degrees around your airplane, the Opto-Autopilot will keep your model in straight and level flight. Just plug the control box in between the elevator and aileron servos and the receiver, and mount the optical sensor on the same horizontal plane as the horizontal stab; you can turn the Autopilot on and off using an auxiliary channel on your transmitter. Your flight controls will obey the transmitter, but their movements will be reduced and your flight will be smoother. Specifications: dimensions—2.75x1.75x0.75 inches (control box), 1x1 inch (external optical sensor); weight—2.4 ounces.

**Hobby Lobby Intl. Inc.,** 5614 Franklin Pike Cir., Brentwood, TN 37027; (615) 373-1444; fax (615) 377-6948.

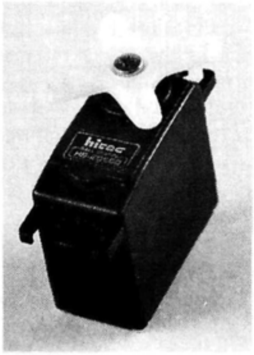
CARL GOLDBERG MODELS INC.

## Smoke System

Available for YS .91 and 1.20 4-stroke engines, this new method of delivering smoke oil is very reliable and is less expensive than methods that use electric pumps and switches. All hardware (except a smoke muffler and fuel tanks) is included.

**Part no.**—110; **price**—$29.99.

**Carl Goldberg Models Inc.,** 4734 W. Chicago Ave., Chicago, IL 60651; (312) 626-9550; fax (312) 626-9566.



HITEC/RCD INC.

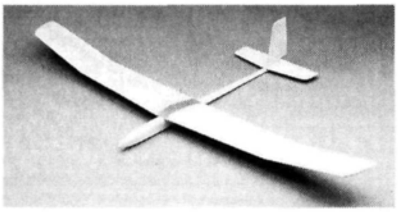
## HS-205BB Servo

This servo has a top ball bearing and a bottom Oilite bearing and uses an indirect drive system. It can be mounted directly on the wing and has an extremely sturdy gear train. At 4.8 volts, the speed at 60 degrees is 0.18 second and the servo generates 39 oz.-in. of torque. The plastic version weighs 1.06 ounces; the metal-gear version weighs 1.20 ounces.

**Part nos.**—HSE0205, HSE0205MG (metal-gear version); **prices**—$39.95, $64.95.

**Hitec/RCD Inc.,** 10729 Wheatlands Ave., Ste. C, Santee, CA 92071-2854; (619) 258-4940; fax (619) 449-1002.

# PRODUCT NEWS



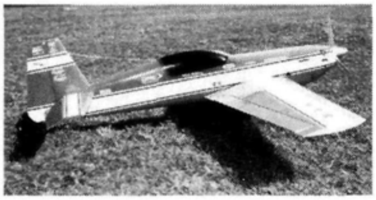
GLOBAL HOBBY DISTRIBUTORS

## Whipit HLG

This kit features a molded-epoxy/fiberglass fuselage that's painted in the mold; a slip-on nose cone for easy access to the radio equipment; machine-cut balsa tail surfaces; and a bolt-on, one-piece polyhedral wing that's sheeted with a thin veneer of fine-grain, lightweight black poplar. The Selig 7037 airfoil at the root changes to a modified, flat-bottom S7037 at the tip for minimal sink and greater wind penetration. The model can be varnished or covered with heat-shrink, and it flies equally well over windy slopes or when launched from a high-start. Specifications: wingspan—56 inches; wing area—333 square inches; flying weight—11 to 12 ounces; wing loading—4.7 to 5.1 ounces per square foot; radio required—2-channel with microservos.

**Part no.**—105300; **price**—$179.95.

**Global Hobby Distributors,** 10725 Ellis Ave., Fountain Valley, CA 92728-8610; (714) 963-0133; fax (714) 962-6452.

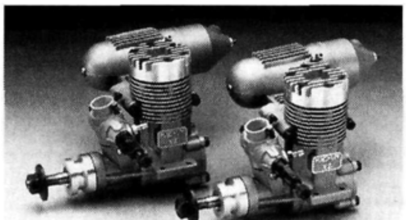


LANIER RC

## Extra 300S

Designed by Bob Godfrey, this Extra features a built-up fuselage and tail group, partially sheeted foam wings and a formed-plastic turtle deck. Specifications: wingspan—102.5 inches; weight—20 to 25 pounds; engine required—3.2 to 5.8ci 2-stroke or 3ci or larger 4-stroke.

**Lanier RC,** P.O. Box 458, Oakwood, GA 30566; (404) 532-6401; fax (404) 532-2163.



MAGNUM

## XL-25 and XL-28 Engines

These ball-bearing, chrome ABC, FSR ported engines feature clean castings with a smooth, bead-blasted finish. Dual needle-valve carbs ensure that both of these 2-strokes will start easily and can be tuned for maximum performance.

**Part nos.**—210625 (XL-25), 210628 (XL-28); prices—$102.95, $107.95.

**Magnum;** distributed by Global Hobby Distributors, 10725 Ellis Ave., Fountain Valley, CA 92728-8610; (714) 963-0133; fax (714) 962-6452.

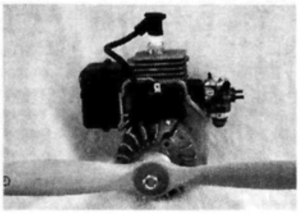

HOBBICO

## Accu-Cycle Battery Analyzer

The Accu-Cycle can simultaneously and independently charge, discharge and condition your transmitter and receiver batteries. It has a 15-hour internal timer and an automatic trickle-charge function, and it can be used with Ni-Cd and nickel-metal-hydride batteries. The unit comes with instructions and a quick reference guide to operation, and it's covered by a 2-year warranty.

**Part no.**—HCAP0260; **price**—$199.99.

**Hobbico;** distributed by Great Planes Model Distributors, P.O. Box 9021, Champaign, IL 61826-9021; (217) 398-6300, fax (217) 398-1104.



JOHN EATON/J&K PRODUCTS

## 25cc Homelite Engine

This 4-pound, hand-start engine has ball and roller bearings throughout. It features an electronic magneto ignition and comes with a muffler and prop hub. Also available is a machined bar-stock rod of 7075 T6 aluminum for SuperTiger 2500, 3000 and 4500 engines. This heavy-duty rod will improve performance on glow and is a must for gas conversion.

**Prices**—$150 (plus $13 S&H); rod—$39.95 (plus $3.50 S&H).

**John Eaton/J&K Products,** P.O. Box 627, Keno, OR 97627; (503) 883-4062.


BALSA USA

## Odorless Gold CA

These state-of-the-art, non-frosting CAs have a measured tensile bonding strength of 4200 to 5,000psi, and they work as well as and have the same characteristics (bonding time, handling characteristics, etc.) as the regular Balsa USA Gold CA products.

**Part nos.**—703 (thin), 706 (thick); **price**—$19.95 for 2 ounces.

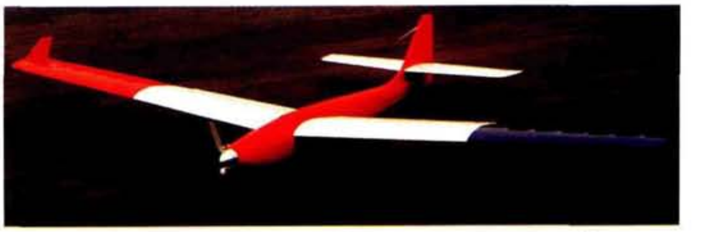
**Balsa USA,** P.O. Box 164, Marinette, WI 54143; to order: (800) 225-7287; inquiries: (906) 863-6421; fax (906) 863-5878.

Descriptions of products appearing in these pages were derived from press releases supplied by their manufacturers and/or their advertising agencies. The information given here does not constitute endorsement by **Model Airplane News**, nor does it guarantee product performance. When writing to the manufacturer about any product described here, be sure to mention that you read about it in **Model Airplane News**. **Manufacturers!** To have your products featured here, address the press releases to **Model Airplane News,** attention: Product News, 251 Danbury Rd., Wilton, CT 06897.

FINAL APPROACH

# HOW FAR?

If records are made to be broken, then some people seem destined to do the record breaking. Two resourceful modelers—visionaries with the demonstrated ability to lead their teams into the record books—have broken the FAI straight-line and closed-course distance records for R/C models (as we go to press, their claims are being approved pursuant to FAI procedures). Their stories are remarkable, yet we must inevitably wonder how long their records will last.



***Ron Clem's Desperado: wingspan—95¾ inches; empty weight—7¼ pounds; fueled weight—10¾ pounds; engine—Irvine .20 diesel; fuel used—Aero Dyne, Irvine, CA; radio—JR* Century 7 (6 servos); batteries—1 Sanyo* KR AE 1200mAh and 1 Gates* 1700mAh Hi-Capacity; additional equipment—Jomar* battery backer, Varsane* VG-40 SG pump; construction—balsa, spruce, ply, Kevlar thread, carbon fiber (California carbon).***

## STRAIGHT-LINE DISTANCE RECORD

On June 10, 1995, Ron Clem, who hails from San Diego, CA, bested the 1994 straight-line distance record held by renowned R/C aircraft record-breaker Maynard Hill, of Silver Spring, MD. Ron's airplane—the Desperado—flew 427.3 miles, or just over 678 kilometers, to beat Maynard's previous record by 98 miles.

***Ron's team (left to right): CD George Finch, driver Jack Cobb, copilot Blake Gookin, driver/observer Bill Clem, chief pilot Ron Clem and driver Bob Murphy.***

***The record-breaking attempt is about to start: copilot Blake Gookin holds the Desperado as pilot Ron Clem waits for the nod from CD George Finch.***

Among other requirements, under FAI rules, the model can't weigh more than 11 pounds, the engine must be 10cc (.60ci) or smaller, and the flight destination must be specified.

Ron's interest in R/C distance records began 17 years ago when he attempted a helicopter straight-line distance record, which ended prematurely after an engine mounting plate failed. Fifteen years later, the bug bit again, and Ron began preparations for the FAI straight-line distance, F3A 21 record for fixed-wing aircraft. Jim Deckert, a friend, provided him with plans for the Desperado (actually, a 33-percent expanded version of Gene Rogers' 1970 *Flying Models* Invader design). Among other mods, Ron installed a custom-built, half-gallon fuel tank and a single, embedded, belly-mounted landing wheel.

***Maynard Hill holds Marvelous Martha, which is dwarfed by the large group of modelers that was needed for the closed-course distance record. Members of the D.C.R.C. Club and the Pegasus R.C. Club of Hagerstown, MD, participated. (Photo by Bill Savage.)***

Initially powered by an Irvine .40 engine, the plane was entered in the '94 Marathon of Flight contest held in Baker, CA. The half gallon of fuel lasted a meager 166 miles. Ron switched to an Irvine .20 diesel engine and happily found that the fully loaded, 10¾-pound plane could still take off under its own power. In May of '95, Ron took second in the Marathon of Flight with a distance of 303 miles. After an engine shutdown owing to a failed exhaust bolt, the plane had a quart of fuel left. Ron was now getting 1,200 miles per gallon!

Ready to challenge the FAI record, Ron's "Pack Rat Aviation Team" gathered in Ocotillo, CA, at 2:30 a.m. on Saturday, June 10, with plans to fly west through Tucson to Lordsburg, AZ. At around 7 a.m., after all necessary preflights and six attempts to ROG, a hand launch was initiated. Ron Clem was the pilot, and Blake Gookin the copilot. Except for the heavier-than-expected traffic in Tucson (and at least one pass at the plane by a bird of prey), the ensuing 10-hour flight was fairly uneventful. Finally, after a day's effort that would set a new record for powered R/C flying, the team reached the local airport at Lordsburg. Ron flew a few slow passes to savor the moment and landed. Victory was at hand.

## CLOSED-COURSE RECORD

Only two weeks later, on June 26, 1995, a team of modelers that Maynard had gathered established a claim for a new world record for non-stop closed-course distance. According to Maynard, "This was the toughest technical challenge ever." The challenge was to develop an airplane that would fly fast enough to cover the distance in the available daylight (14.25 hours) without running out of fuel.

Maynard's model—the Marvelous Martha—with a 64-inch wingspan and powered by an O.S.* FS61 4-stroke engine fitted with a C.H. Electronics* electronic ignition, flew 776 miles (1,250 laps of a 0.5k course) to beat the previous record of 1,239k that had been established in 1986 by Aghem Gianmaria in Turin, Italy. The model's dry weight was 5.5 pounds, and its fueled weight was just under 11 pounds. To establish the new closed-course record, pilots Rob Rosenthal and Doug Harper took turns at the sticks for 13 hours.

Will Maynard challenge Ron's distance record? Maynard Hill, past president of the AMA and former delegate to the Modelling Committee of the FAI, had achieved no fewer than 21 FAI world records as we went to press. As might be expected, he is now preparing for his next attempt at the straight-line distance record. Will Maynard break the current record? We'll keep you posted. —*Tom Atwood*

**Addresses are listed alphabetically in the Index of Manufacturers on page 134.*